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CONTRIBUTION TO THE LIFE-HISTORY OF THE CALIFORNIA MASTIFF BAT

BY A. BRAZIER HOWELL

[*Plates 5–6*]

Among the bats found within our borders, there is probably none more interesting than our largest species—the California mastiff bat (*Eumops californicus*). First discovered at Alhambra, California, by E. C. Thurber, it has always been considered decidedly rare, and is poorly represented in even our largest museums.

During the past year, I have had exceptional opportunities to study this form, and now after a great deal of hunting, which cannot better be described than by the word "snooping," poking my nose into every likely and unlikely place, and even advertising, I have no hesitancy in pronouncing it a common species in the orange section or thermal belt of Los Angeles County. However, to be successful in finding it, one must employ no little energy and perseverance. Almost all of my observations were made in the company of L. Little, and with his assistance.

I imagine that in the days before houses were built in this section, "mastiffs" were in the habit of roosting in cracks of occasional cliffs. Undoubtedly, they sometimes used hollow trees as well, but not to a great extent, for trees with cavities high enough to suit them were anything but plentiful. At present, they may be found in a variety of situations, such as attics, large warehouses, or cracks in high masonry, but the colonies are not nearly as populous as are those of most other bats. I consider that twenty is rather a large number for a colony, although as many as seventy may be found together. I have heard

rumors, which may or may not be so, of roosts of this species having been found but a few feet above the ground, and it is undeniably true that many single animals have been secured while hanging at a low elevation, but all five locations from which I have secured them, besides a roost "belonging" to L. E. Wyman, have been so situated that the bats had an uninterrupted drop of at least twenty feet before taking wing. I am so sure of the necessity of this point that I would not think of searching for them where this condition did not obtain. In the aggregate, I have spent hours studying dozens of individuals in my screened porch and trying to make them fly, but whether in January or during the heat of June, they all refused even to flutter their wings when dropped from as high as I could reach while standing upon a chair, although they were exceedingly lively and scrambled about the floor with the greatest celerity. I have even, at different times, caught thirty individuals which Little dropped to me from at least thirty feet above, and although they spread their wings so as to break their falls, not one tried to fly; and this on sunny and fairly warm days. Last spring, one entered the open window of a vacant room, alighted on a lace curtain and finally died—evidently because it could not leave with so little "take-off." I found one dead beneath the eaves of my cow shed, and another on the floor of a low building. I discovered about eighteen which had died in an attic because the ventilator at that end of the gable had been plugged, and they could not or would not fly the few feet to the other end of the building where there was a good exit. On the other hand, L. E. Wyman has succeeded in making several fly in his screened porch, although it was earlier in the season and presumably cooler than when I have tried the same experiment. The probable explanation of this is that unusually active individuals, or those which for some reason are in an unusually active condition, can take wing from low situations, but that the majority, especially during the cooler parts of the year, need to gain momentum by taking a long dive, before flying.

Somehow, *Eumops* has an exotic appearance, as if it were an accidental visitant to our fauna rather than an established resident. The genus is a tropical one, and our species seems rather hard put to it to survive. In large colonies of other bats, one rarely finds a dead individual. I have not only found dead mastiffs in every colony visited, but three others in haphazard spots as mentioned, and have heard of still more. One really would be justified in pronouncing it a case of the gradual elimination of the unfit if it were not for the fact that both available shelter and food, because of agriculture and irrigation, are much more abundant than they could have been in the past.

My first mastiff was secured October 23 from the ridgepole of a large, abandoned packing house a mile from my home near Covina, Los Angeles County, and was in such a position that we had to shoot it. This is not a regular roost, for there are few or no dark nooks for hiding, but its vicinity is a favorite hunting ground for several species of bats, and the mastiffs occasionally use it for a day or two at a time, for I found another there later in the winter.

The next find was near Colton, San Bernardino County, and was located through W. C. Hanna, to whose kindness we are especially indebted. It was situated in a crack between an outside timber and the wall of an old stone building, with a sheer drop below it of about thirty feet. On this building there were other similar situations, but there was a little old guano beneath only one other crack. This roost contained at least forty, and possibly sixty bats. Little, Hanna and I visited this on November 5, when eighteen were secured, equally divided between the sexes. Another visit was made to this colony November 24 and twelve more captured, but we could tell nothing in regard to the number remaining, except that there were quite a few crowded into a dark corner. On April 23 there were no bats there. I do not believe that our activities drove them away, for I have taken every bat from a colony and found more later. Rather do I think that they temporarily sought some other location for breeding, or that it was used as a winter roost only. However that may be, a less suitable spot for wintering it would be difficult to find. The stone which bounded one side of the cranny was very cold, of course, and in addition, the aperture of the space occupied was fully as large above as below, with nothing to shelter the inmates when the cold, driving rain of the winter storms beat upon them. Still, there were the desiccated remains of but two, and that is an unusually low mortality.

Another small colony was discovered March 20 in a large house within a short distance of my ranch. Previously, the bats had occupied the attic, but their noise was such a nuisance that the ventilators were covered with netting and the twenty or thirty bats thus imprisoned were caught and killed. At the time of my visit, I found two live bats between the slats of one ventilator, and in another, four, one dead and blown with small maggots, another dead only a few hours, and two others which were decidedly weak. This was at the end of a spell of cold, rainy weather, but I cannot see why these should die of cold and hunger while those secured on the eighteenth were fat and lively. A possible explanation is that the latter were in a protected situation,

while the ones in the ventilators were continually subjected to a cold draught, which may have rendered them torpid throughout a protracted period. When I secured these individuals, I surreptitiously pried loose a corner of the screening, and what was my delight, upon visiting the attic December 5, 1919, to find about seventy mastiffs in the gable. They were hung to the shingle studs beneath the sloping roof, a short row to a stud, and thus overlapping as if they were animated shingles—truly a sight to delight the heart of a mammalogist. I took a few of these and found that they were of both sexes, as usual.

A colony was located in a small, two story house near my place on April 15, the bats gaining entrance through a slatted ventilator at the end of the attic. It was a very old roost and the guano was thick beneath it. There were seven mummified bodies upon the floor, I captured thirteen live ones, and there were at least eight or ten more in some cracks, but they were very lively, keeping up a great racket while scrambling about their retreat, and braced themselves so securely that it required much persevering manipulation with the long forceps to secure them.

On March 18 we discovered a colony of thirteen mastiffs in the attic of a two story building near Azusa, Los Angeles County. From this we took ten. I visited this again on May 31 and took two females, but left a single male. At the other end of this attic was a colony of *Nyctinomus* and *Eptesicus*. When Little visited this spot in late December there were no bats present.

This species, like its near relative *Nyctinomus*, has a very penetrating odor—decidedly more so than that of most bats—and this will cling for months to a sack in which the animals have been carried. I have always found both sexes together, even just before young were to be expected, and the females outnumber the males by about two to one. The average measurements in millimeters, taken by myself, of ten males and twenty-two females, are, respectively for the sexes—length, 175 and 174; tail, 60.7 and 57; expanse, 540.7 and 526.

The gland on the lower throat with its external opening is easily overlooked when inactive, and indeed I have been able to find no mention of it in publications. Ordinarily, it appears externally as a tiny dent, and internally, the skin is here attached to the body by a sort of tendon. When the males are most active sexually, the gland swells, is then shaped like a small-holed doughnut of a grayish, cheesy formation, and measures 14 mm. in diameter by 4 in depth. This makes a corresponding swelling externally and the opening is much enlarged,

the surrounding hairs being moistened by the exudation of a slimy matter with a very strong odor. The glands were active in most of the males secured March 28, and in but one of those taken December 5. By the middle of April the glands have greatly subsided. As far as I am aware, all of the European bats which have been dissected and examined in this connection, have been found to breed in the fall, or at least some time during early winter. The incipient ovule then remains in a quiescent state in a manner and by a means on which it is not necessary here to dwell at great length. The embryo does not reach its place of development nor start to form until warmer weather and the consequent increase of chiroptine activity stimulate it to grow, and this beginning can be retarded for several weeks by keeping the prospective mother in a low temperature. There is no reason to suppose that most of our bats differ in this respect, although the phenomenon probably does not obtain with tropical bats. My experience has led me to believe that probably the rut does not begin at the same time with all males, but that its start may depend on the animal's condition or some indeterminate cause. At any rate, it has been ascertained that the rut of some English bats lasts for a comparatively long time, and fertilization probably takes place at any time during the winter that opportunity offers.

Females secured April 15 each contained a single embryo with a uniform length of three-quarters of an inch. As I was particularly anxious to examine the young and was leaving for the north the first of June, I took two females May 31 which were very heavy indeed. Had I known that it would be so long before the young appeared, I would not have disturbed them, but I had daily expectations while they were in captivity, and as they seemed to be perfectly healthy and cheerful, I kept one until June 30, when a young one was born, but it had then been dead for several days and I could not save it. It was surprisingly large and dull black in color. The other female I presented to the Museum of Vertebrate Zoology and it died June 14.

These bats may either hang in a horizontal row, or crowd singly into crevices. A favorite position is hanging vertically with the whole length of the legs hooked over onto a horizontal surface above, and slightly braced by the bend of the wings. They often vibrate the body gently for minutes at a time. Normally, the ears are held in the position shown in the illustrations, but the eyes are then concealed, so upon the slightest disturbance the ears are raised until the upper surfaces almost touch each other, and the animal will shrink away as far as

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possible. Although their unwillingness or inability to fly at once renders them rather easy to catch, they try hard to escape by crawling. They are very pugnacious and can inflict a decidedly ugly slash with their needle-sharp incisors, as I can testify. When touched, they utter a shrill, chattering scream of astonishing volume, with the mouth opened to the fullest extent. The special formation of the lower jaw enables them to open their mouths to even a greater extent than is usual among bats, and this character must in some way be connected with their food or manner of obtaining it, but upon this point I can shed no light, for the stomachs of all those examined were empty. I have never succeeded in making a captive mastiff take food, even by placing a variety of insects in its mouth, but one of the captives kept by L. E. Wyman ate disabled insects, during the night. The bat seemed afraid of bulky prey like Jerusalem crickets even when they had been rendered helpless. However, if it habitually feeds only upon small fry, then for what is that huge mouth?

Eumops shares with *Nyctinomus* the distinction of being among the most agile of bats while on the ground. With wing tips folded above the back so as to be out of harm's way, they scutter across the floor in a sort of gallop, while the action of their "arms" reminds one of nothing so much as an "over-hand" swimmer.

I have found that certain bats which spend the summer in the southern part of California and migrate at the approach of cold weather, can go without food for very little more than forty-eight hours without dying, and this is as might be expected. They shun the cold and there are seldom or never any storms during the summer that continue long enough to prevent them from securing at least a little food every night. However, those which spend the winter, even in our thermal belt, must be of sterner stuff. The winter storms are not precisely warm and often last for three days or more. In addition, there may be a solid week of cold weather with ice every night, and although this does not distress *Nycteris*, for instance, I do believe that it would keep *Eumops* indoors. Hence, it is necessary that the mastiffs be able to fast, and fast they can. Although not hibernating in the true sense of the word, they enter what may be called a voluntary hibernation or torpid sleep. If placed in a cool situation, even late in the spring, they become torpid, cold, and to all appearances, dead. I kept one thus from November 5 to December 13, and usually, when examining her daily, I was obliged to shift her wings into different positions before I could detect the slightest sign of life. However, no matter how cool the day, disturbance

DORSAL VIEW OF CALIFORNIA MASTIFF BAT
(Reduced)

(Howell: The California Mastiff Bat.)

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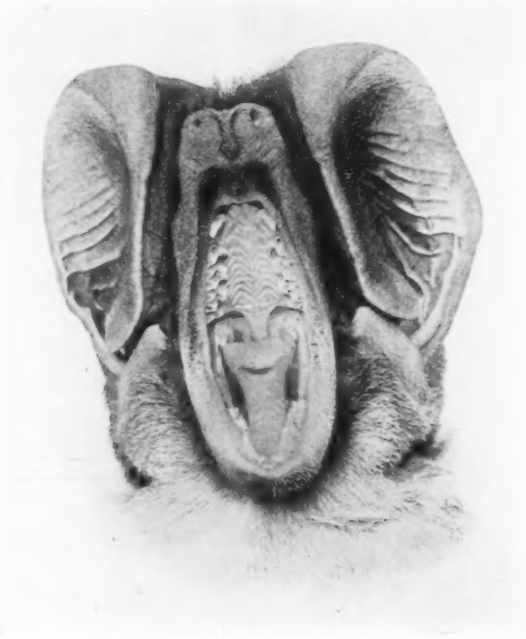

HEAD OF CALIFORNIA MASTIFF BAT
(Twice natural size)

(Howell: The California Mastiff Bat.)

UNIV. OF MICH.

for a few minutes was sure to rouse her ladyship into full vocal and muscular vigor. She refused all food, and at the end of six weeks, quietly died, although she was not emaciated and still had a slight reserve of fat. However, I am satisfied that the mastiffs take regular flights during the winter, when the weather and the state of their appetites are both propitious. During the middle of February, when there was a skim of ice almost every night, one roosted in the old packing house previously referred to, but stayed for only three days at most, and Hanna saw several leave the Colton colony one evening during the winter.

As far as I am aware, no one has ever observed this species while it was hunting. Several times, just at sunset, very large bats have flown towards the hills, singly, at a great height above the ground, uttering strident cries which were plainly heard inside of my house. These, D. R. Dickey and I took to be mastiffs. On the other hand, Hanna and I have each observed them leaving the roosts at very late dusk, dropping plummet-like from the exits and curving away when almost to the ground. Habitually, they must be late fliers, and possibly move at a considerable height above the ground, for they are too big to go unremarked if awing before dark. I have ascertained that the evening flight lasts for only about three-quarters of an hour, and they then return to roost. Presumably, there is another flight just before dawn, but I have never verified this supposition.

MAMMALS OF THE ST. MATTHEW ISLANDS, BERING SEA

By G. Dallas Hanna

The St. Matthew Islands are located in Bering Sea about 220 miles to the northward of the Pribilof Islands, and about the same distance west of the Alaskan mainland. The group consists of three islands, which, named in order of size, are St. Matthew, Hall, and Pinnacle Islands. It was made a bird reservation by executive order of February 27, 1909, being officially known as the Bering Sea Reservation. Owing to the distance of the islands from the regular channels of travel, opportunities for naturalists to visit it rarely occur. It is barren, treeless, uninhabited and surrounded by dangerous and poorly charted waters.

Through a request of the Biological Survey of the Department of Agriculture I was detailed to make an examination of the reservation in June, 1916, but owing to the fact that the ice packs remained in that vicinity until after the middle of the month this was impossible. In July, however, the trip was made, and six days were spent on St. Matthew and Hall Islands. Arrangements having been made with the Coast Guard Service for transportation, I left St. Paul Island on the morning of July 7, on the Cutter *Unalga*, Capt. F. G. Dodge in command. The next morning the spires of Pinnacle Island were in full view and at noon a landing was made on St. Matthew near Cape Upright. Between then and the twelfth almost the whole of this island was examined, and on the thirteenth we went to Hall Island. Pinnacle Island was not visited on account of adverse weather conditions. I wish to express my appreciation of the favors extended me by the Coast Guard Service and especially by Captain Dodge and the crew of the *Unalga*, every man of whom willingly and eagerly assisted me on every occasion.

St. Matthew Island is about 22 miles long by two to three miles wide and is slightly curved to the north. Its mountains rise as high as 1800 feet and are in most cases, weather-worn and smoothly eroded. Some of them have mosses and lichens growing to the tops, but others, especially in the center of the island, are entirely devoid of vegetation. The rocks forming these latter are weathered into very small fragments, set edgewise and close together and making a natural pavement.

Most of the valleys are covered with reindeer lichen and mosses and in many favorable places there are true tundra bogs. Vegetation other than mosses and lichens is dwarfed and scant in most places. The rank growths of wild parsnip and wild rye found on the Pribilofs are entirely absent. There are a large number of fresh and brackish water

lakes on the island, many of which have been formed by the sea-built dykes extending from one headland to another. The tide ebbs and flows in some of these, forming lagoons. There are a large number of fresh water streams, many of them a dozen feet across. They wind through the tundra swamps with undercut banks which form ideal spawning and feeding places for the innumerable trout found here.

The mountains are cut into by the sea on every side of the island, making long stretches of towering cliffs, between which the sea has built up beaches of such an extent as to give the impression that the island is much older than the Pribilofs. These cliffs display wonderful geological formations. There are beautiful blues, yellows, greens and bright reds in layers or dykes, and in places throughout the mass run seams of pure white calcite from two to twelve inches thick.

Evidences of comparatively recent earth disturbances are seen about two miles below Cape Glory of Russia on the south side of the island. The earth and cliffs are torn and tumbled in the greatest confusion. New slides are seen and the beach line boulders are not much rounded. In some places rocks are constantly falling, making it dangerous to go beneath the cliffs. Here are nodules from two inches to two feet in diameter composed of a green mineral-like jade, and there are numerous seams in the country rock of banded agate. There is one cliff half a mile long of undoubted sedimentary origin. Numerous fossilized trees, some two feet in diameter, are embedded near the base. All seen were in a recumbent position and as black as anthracite coal.

The large number of cliffs with their grand scenic display are notable as the nesting places of countless sea birds. Of all the places I have visited St. Matthew is rivalled in this respect only by that incomparable bird cliff on St. George Island, but the ledges on St. Matthew are more nearly perpendicular and thus afford less favorable nesting sites. The lines of driftwood indicate that the island as a whole has had a recent elevation, or that some enormous seas which did not reach the Pribilofs carried the logs high above tide-mark. Some logs are about 100 feet above the calm weather water line.

Hall Island is entirely bold and rugged and has no true beach. In fact the top of the island can only be reached in a few gullies where small streams empty into the sea. The vegetation and character of the upland appeared similar to St. Matthew. Pinnacle Island is wedge shaped and has towering spires projecting high into the air. It is so steep and rugged that snow does not lie upon it. Probably the base of the cliffs might afford a landing place in calm weather but whether or not the walls of the island could be scaled was not ascertained.

The action of the ice on these islands seems inconsequential. No worn pebbles were found back of the beaches nor are glaciers present. Snow probably remains most of the summer in some of the canyons, since it was very deep in places in early July.

LIST OF MAMMALS

Whales.—The vicinity of St. Matthew Island has long been known for the abundance of whales at certain seasons. The great numbers of bones of these animals on the beaches, as compared with such islands as the Pribilofs, is an indication of their relative abundance. The conditions attending this investigation prevented the collection of a series of specimens of the several species identified on the beaches, and the positive determination of some of the kinds which may be represented there and in the surrounding waters.

Balæna mysticetus. Bowhead Whale.—The bones of this species are exceedingly abundant on all beaches. A pair of mandibles 19 feet long were found in the center of the long north shore beach and vertebræ by the hundred were observed; some were far back of the high tide mark, half buried in the tundra, and others showed fresh and white among the drift logs. Two skeletons lay bleaching on the south shore abreast of Pinnacle Island.

Balænoptera velifera. Humpback Whale.—A skeleton of this species lies scattered on the south side of the spit connecting Cape Upright with the main portion of St. Matthew. The longest pieces of baleen were about four feet.

Sibbaldus sulfureus. Sulphur-bottom Whale.—A skull with baleen of this species was found on the spit connecting Cape Upright with the main island.

Orcinus orca. Killer Whale.—Bones of a killer were noted in two places on St. Matthew, those most recent being on the north shore near the center of the island.

Berardius bairdii. Baird's Whale.—A carcass of this rare ziphoid had washed into the lagoon on the south side of St. Matthew Island, two miles below Cape Glory of Russia. The skull was in good condition but rough weather prevented the taking of a boat around to the place, and it could not be carried across the bogs to the other side. A periotic bone was preserved however and the identification verified by True's excellent work on this family (Bull. 73, U. S. Nat. Mus.). This specimen seems to mark the known northern range of the species.

Phoca sp. Hair Seal.—A colony of hair seals was found by Captain Dodge July 8 on an outlying rock abreast of Waterfall Head, but no specimens were secured. From the number of young observed he was led to believe the place a breeding rookery. Another lot was seen on the north shore near Cape Glory of Russia but all shots miscarried and efforts to collect good specimens were unsuccessful. Two imperfect skulls were found on the beaches and they represent two species.

Odobenus divergens. Walrus.—A herd of about 500 was seen near the middle of the north shore, cruising along with the ship. Walrus skulls were common on the beaches and the officers and men found several pieces of ivory. They haul out on the northwest cape of Hall Island under the high cliffs, so I am told by

Captain Lane, but at no other place on either island. Five carcasses were found on the beaches, all of young animals which had been crushed by the ice. I am led to believe that the majority of these animals which are washed ashore have been killed in this manner. Four carcasses came ashore on St. Paul Island and three on St. George Island during the winter of 1915–16, and examination of two of these proved that they had been crushed. Some floaters may occasionally come in after having been shot; but it seems that, since hunting is prosecuted at such a distance from the Pribilofs, their bodies would be somewhat decomposed before they could float so far, even if the currents were favorable, which is unlikely. Occasionally pelagic hunters may come close by however and the shot animals might be found in a good state of preservation.

Callorhinus alascanus. Fur Seal.—Fur seals were common up to within eight miles of St. Matthew Island in June, 1916. While the ship was endeavoring to reach the island eight animals in all were seen by me, and more were noted by the men on watch. I did not see more than two together. The presence of these animals here at this early season led me to believe that possibly a new hauling ground had been established on the St. Matthew group. Investigation of most of the St. Matthew coast line in July, however, revealed no signs of such a hauling ground nor were any animals seen in the waters of that vicinity.

Alopex hallensis. White Fox.—The white fox is fairly common on the reservation. Animals or evidences of them were seen at every landing. One adult female was collected, and two skulls were found. Two trappers spent the winter here in 1912–13 especially for this species and I heard from one source that their catch was almost worthless and from another that it was of considerable value. Their success is doubtful since the attempt has not been repeated. Undoubtedly the number of foxes ordinarily present depends on the food supply, which under natural winter conditions cannot be large.

It has been proposed to lease St. Matthew Island for a fox farm, but as it is ice-bound for many months of the year, even to the middle of June, as in 1916, this would seem an unwise action. It would be impossible to procure food for a surplus of stock in winter without preying upon those forms of animals which at present it is desired to protect. An insufficiency of food would certainly lead to cannibalism among the foxes or to their wandering away on the ice pack. It would seem therefore that to grant a lease for a fox farm here would mean only an exclusive privilege of trapping the natural stock. If the time should come when the foxes would seem to be exterminating certain species of birds or other animals which it is considered of greater importance to perpetuate, then it will be time to take all foxes away from the island. Not until then should the natural balance be disturbed.

It is understood that the two trappers who were on St. Matthew Island during the winter of 1912–13 kept a journal which is now in the possession of the Coast Guard Service in Washington.

Thalarctos maritimus. Polar Bear.—In 1874, when Elliott and Maynard landed on St. Matthew in midsummer, polar bears were very abundant. There is a tradition that during the time of Russian occupation a party of five men from St. Paul Island landed on Hall Island where they built a cabin but had to leave it owing to the marauding of the bears. The remains of an old Russian house were found on that island. Captain Lane told me that bears were found up until

sometime in the 90's when a party from the revenue cutter Corwin landed and shot 16.

The old trails Elliott mentions are still plainly seen, worn deep into the tundra. Skulls of several animals were found, all with bullet holes in them, and two were preserved. Very probably a few bears may still come down in winter on the ice pack but they have been hunted so much of late years that they cannot be common.

Microtus abbreviatus. Hall Island Meadow Mouse.—Runways of rodents completely undermine certain large areas of both St. Matthew and Hall Islands, but at the present time most of them are unused. Indeed "fresh signs" of mice were rarely found and the result of my trapping is a single adult female, skin and skeleton. The remains of others were collected in owl pellets and there appears to be more than one species. This material has not been critically examined, but in all probability it includes bones of *Microtus a. fisheri* Merriam, described from specimens taken on St. Matthew Island in 1899 by Dr. A. K. Fisher, during the visit of the Harriman Expedition.

NESTS OF THE WESTERN FOX SQUIRREL

By H. L. Stoddard

[*Plate* 7]

All accounts of the habits of the western fox squirrel (*Sciurus niger rufiventer*) that I have been able to find, speak of the young as being brought forth in hollow trees, no mention being made of the carefully constructed open nest used for this purpose in parts of the range of this squirrel.

In the sand dunes of northwestern Indiana particularly, where fox squirrels are still fairly abundant, the young born in early spring at least are usually brought forth in a very ingenious type of open nest, though hollow trees are common. These nests are round or oval in shape, tightly woven of freshly cut oak or other tough twigs. Inside of this twig shell comes a thick compact wall of large leaves, evidently pressed into shape while damp, making a smooth, tough lining capable of resisting wind, cold and rain. The nest proper is then made of soft inner bark, shredded leaves and other material.

The entrance hole is on one end and is just large enough to admit the owner, the surrounding fiber often nearly closing the opening. The accompanying figure, which is from a group prepared for circulation in the Chicago schools by the N. W. Harris Public School Extension of Field Museum, shows a typical nest in the original crotch, with one side removed to show details of construction.

NEST OF THE WESTERN FOX SQUIRREL
(Courtesy of the N. W. Harris Public School Extension of Field Museum)

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These nests are entirely different from the loosely constructed summer nests, and are so compactly built that they frequently remain in place many years, the squirrels using them a great deal even in coldest weather. From the ground they look something like hawks' nests, piles of sticks being all that are visible.

The three or four young, blind and nearly naked, are born in late February or March in this region, as the following records show. Nest containing three young near Millers, Indiana, March 8, 1914. Another nest located near-by the same day by my campanion, Mr. L. L. Walters, contained four young about two weeks old. Millers, March 17, 1914, four young, about two weeks old; Dune Park, Indiana, April 1, 1917, three young a week or ten days old. I have never found a second litter later in the season.

Other nests of this type containing young, and dozens of empty nests examined by Mr. Walters and myself, have invariably been placed in pine trees, from twenty to forty or more feet above the ground. As a nest of this type must be built from the inside, a foundation of encircling limbs such as is offered by the northern scrub pine is necessary and may explain the absence of domiciles of this nature in the greater part of the range of this squirrel.

These winter nests are often placed in close proximity to some good old den tree, to which the squirrel can retire if disturbed, and the surrounding trees are likely to contain one or more of the temporary nests used in summer, simply twigs and leaves cut green and piled into a convenient crotch.

Young squirrels were found on a number of occasions in Sauk County, Wisconsin, in nests identical with those found in the Indiana dunes, even to being built in scrub pines, though the use of hollow trees is more general in that section, and the season later. On one occasion while examining a nest of this kind in a very small scrub pine the female squirrel jumped the sixteen or so feet to the ground, leaving one young one, just born, in the nest; proving that in this case at least the young had not been transferred from a hollow tree.

THE TEST OF THE SUBSPECIES

By P. A. Taverner

In the Journal of Mammalogy, Vol. 1, No. 1, pp. 6–9, appears an article by Dr. C. Hart Merriam advocating that the amount of differentiation be used as the test of specific or subspecific status, rather than the generally accepted one of intergradation. It is with some trepidation that I dare take direct issue with so eminent an authority but the case seems so clear against the proposal and its acceptance is so fraught with possibilities of confusion that I feel justified in lodging a protest.

Doctor Merriam makes much of the uncertainty of human judgment in estimating the probability of intergradation when direct evidence of it is lacking. For the sake of these minority cases where the human element may give varying results, he advocates the recognition of the amount of difference exhibited rather than the presence or absence of intergradation as the test for specific status; thus throwing open each and every case, instead of an occasional one, to the uncertainty of personal standards of judgment. It looks like out of the frying pan into the fire and the choosing of the greater instead of the lesser of two evils. Under the one standard we have numerous cases where intergradation can be demonstrated and subspecific status fixed. Under the other all are equally uncertain. It would seem more logical to go to the other extreme and ascribe every difference to the specific that cannot be demonstrated to intergrade with others. This would however be carrying logic to an extreme and I see no real reason why we should not continue to rely upon the good judgment of experience to assume the probability of intergradation where data is incomplete, readjusting mistakes according to new evidence. Finality can thus be gradually approached even though it may never be perfectly attained. The occasional transference of species to subspecific status and the converse are not serious disturbances so long as we keep the fundamental differentiation in mind and remember that in many cases intergradation is hypothetical and still awaits demonstration.

It is also more than probable that a strict adherence to the proposed criterion would land us in greater confusion than we experience now. Under it, on the evidence of specimens on which most of our conclusions are based, we would class the gray-cheeked and olive-backed thrushes as mere subspecies whilst the extremes of such forms as song sparrows, fox sparrows and horned larks we would raise to full specific status.

It is beside the question that in some particular cases such a proceeding might conceivably be an advantage for it is recognized that extremes of obvious subspecies sometimes differ more in apparent characters than do other distinct species. It is thus apparent I think, from the standpoint of mere expediency, that the amount of divergence as a test of the lower systematic units is open to serious question.

The only logical ground for applying a quantitative rather than an intergradational test to the subspecies is that of the instability of species. If species are liquid quantities flowing imperceptibly into each other the amount of difference by which they are characterized is the only practical means for their recognition. If, however, the species is a definite entity it must be cut off sharply from all other similar entities and degree of divergence becomes unimportant and isolation (discontinuity) its final test. Herein lies a conflict of ideas.

Those who concentrate their attention on the paleontological evidence are prone to regard the species as a mere concept, an ever varying quantity in constant state of development, adopted for convenience in referring to arbitrary points along a continuous line of progress. The modern zoologist however finds species the termination of lines of descent, and each sharply marked off from the other. As both of these reasonings are demonstrable it is apparent that in the word "species," as generally accepted, we have lumped two separate concepts. Certainly contemporaneous and consecutive species bear fundamentally different relations to each other and between themselves, and eventually will probably have to be differentiated by systematists. It is only the fragmentary nature of our geological evidence that has heretofore concealed the essential difference between species merging into each other along a line of descent and species the outcome of independent lines of descent. Intergradation is a concomitant of the first but incompatible with the latter.

It can be urged that evolution is an always present activity, that the processes of the past are continuing in the present and any system founded upon the stability of the species is doomed to eventual confusion. This may be correct philosophically, but in practice need hardly be considered in dealing with modern material. Within historical times we have absolutely no evidence of serious evolutionary change. A system that would have sufficed for three thousand years in the past will probably do for an equal time in the future. By the time evolutionary change introduces serious disturbance in the present scheme of things it is probable that our whole classification system will have been

scrapped for something better or else altered beyond recognition. In the meantime I think we are safe in basing our working system on the convention that existing relationships are practically stable.

Though all standards of taxonomic measurement are not mutually transferable between paleontology and modern zoology it does not follow that paleontological evidence should be neglected by modern systematists. As its evidence increases and its lessons become plainer, paleontology must be, even more in the future than it has been in the past, the rule and guide of our classification. We should however bear in mind that concepts that apply to the one may require modification before they can be transferred to the other.

However otherwise it may have been in the past or may be in the future, at the present moment or on any one given geological horizon, the species is a definite entity and its essential character is its genetic isolation. Absence of intergradation with other forms is the only test of the species as it exists at present. There is a barrier that isolates modern specific groups one from another, individualizes contemporary species and prevents wholesale mongrelization. Just what this barrier may be we cannot say with confidence, nor is it altogether necessary to the present argument to do so, but the agent that seems most capable of producing present results is the degree of fertility between such groups. When fertility between divergent forms breaks down, when differentiation progresses to the reproductive processes sufficiently to form a handicap to crossbreeding, genetic isolation ensues that forever separates the varying branches of a common stock and a new species is born. Whatever the mechanics may be that tend to hold a species true and prevents promiscuity, subspecies are incipient species, and I do not see what they can be but variations tending towards, but not reaching, specific status until connection with other forms (intergradation) is broken down and isolation established. Thus intergradation is not only an indication of a condition but it is the condition itself and the refusal to recognize it as the essential quality of the subspecies seems to be a denial of fact. It should be admitted, and can be without discrediting the fundamental argument, that intergrades will not always be discovered. Material from critical localities may not be available or connecting distributions may be obliterated through geographical or ecological changes. Subspecific variations may appear in disconnected communities and give rise to discontinuous distribution where even intergradation through individual variation may conceivably be obscured. without in any way denying the relative status of

the forms concerned. The accidental absence of intergrades in these cases complicates the demonstration but cannot alter the fundamental facts. No system of classification has ever entirely done away with the necessity of exercising some judgment and probably none ever will, and the best we can arrive at is to reduce the human equation to its lowest possible terms consistent with the facts of nature. The *possibility* of intergradation where contact between races is physically impossible must necessarily be estimated under the guidance of what evidence we have. The test of intergradation or its possibility where physically prevented gives a far more definite basis of judgment than unmeasurable generalities expressed as vague comparatives of difference. That such proceeding does in practice and in some cases, approximate the criterion laid down by Doctor Merriam is beside the point as the resemblance is superficial and not fundamental. In one case it is frankly an expedient, a suggestion or means to an end, in the other it is the end itself and final.

In this argument I do not forget such cases as the hybrid flicker nor Lawrence's and Brewster's warblers. These if anything substantiate the view that degrees of sterility form the specific boundary lines. That the parent forms of these anomalies are not mongrelized is evidence that such cross breeding is under a handicap as against purer lines of descent; for it is a mere matter of mathematics to prove that otherwise species that hybridize regularly, even if only occasionally, would eventually merge. I have little doubt that the hybrid flicker which shows no appreciable evidence of sterility is only continued through fresh crossings of original stock and that should either parent form be exterminated, it would in a few generations die out through inherent weakness and inability to compete with either of its more virile parent forms.

Therefore, for reasons of both expediency and philosophy, stability of nomenclature and the teachings of evolution, I respectfully submit that the fact of intergradation is the only proper and workable test of subspecific status and should be firmly held to by all students of speciation.

OLD AND NEW HORNS OF THE PRONG-HORNED ANTELOPE

By Vernon Bailey

[*Plate 8*]

The fact that our so-called antelope sheds and renews his horns each year has come at some time as a distinct surprise to every student of mammals—it has seemed to him almost impossible of belief and difficult to explain. Much time and space have been devoted to the study of the shedding and renewing of the hollow horn of this animal, and it is still safe to assume that we do not know all about the process. The history of our knowledge in regard to it presents an interesting chapter of doubt, disbelief, and discussion.

For over thirty years I have been for part of almost every season over some of the antelope country and have followed the herds on their summer, winter, spring, and fall ranges. I have found many skulls and skeletons, but never until recently have I found, or heard of any one finding, in the open country, a shed horn of this animal. In Yellowstone National Park, on April 7, 1916, at the edge of a melting snow bank near Blacktail Creek, I picked up a fair sized horn of a buck antelope that evidently had been dropped in the soft snow of the preceding fall or early winter and thus was protected from coyotes until the snow melted away. It was wet and soft and leathery about the base and had the strong hartshorn (ammonia like) odor characteristic of these horns. It could not have remained uncovered very long without being found by the keen-nosed coyote, who, being in the usual hungry condition, would certainly have made a partial lunch on its edible base and probably buried the rest to become more mellow with time and moisture. This seems the most reasonable explanation for the scarcity of shed antelope horns. The horn was carefully wrapped in a handkerchief, brought to camp, and dried until hard; it was then photographed and placed in the Biological Survey collection in the National Museum. The photograph shows imperfectly some of the long white hairs lining the base of the hollow horn. These hairs had pulled part way out of the shell as it had loosened from the bony core to make room for the growth of its successor, and while they show only at the edge in the illustration, they really cover the inner surface of the horn for a considerable distance.

On March 9 of the same year I found a fully grown young buck antelope that had been killed and partly eaten by coyotes. It had

1 2

FIG. 1. NEW GROWING HORN OF MALE ANTELOPE, WITH HARDENED TIP AND SOFT, HAIRY BASE, TAKEN MARCH 9

Beginning of prong shown by knob on left near base. Reduced from 6¾ inches in a straight line from top of curve to base.

FIG. 2. SHED HOLLOW HORN OF ANTELOPE PICKED UP APRIL 7 AT EDGE OF SNOW-BANK IN YELLOWSTONE PARK WHERE DROPPED IN FALL OR EARLY WINTER

Showing much of the old hair at edges and inside of horn, and traces on outer surface. Reduced from 10¼ inches in straight line from tip to base.

(Bailey: The Prong-horned Antelope.)

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half grown young horns standing about 7 inches up from the crown, with hard horny tips extending back about 3 inches from the points, and soft skin covered with long coarse hairs over the rest of the horns. These long black and white and gray hairs were firm and wiry like the hairs of a cow—not soft and spongy like the hair over the antelope's body. They were growing from the surface of the black, soft skin and evidently later would have become embedded in the horny covering as it thickened and hardened into the rough, strong shell of the ripened horn. As the horn thickens and hardens from the tip downward, this hairy covering is buried, rather than absorbed, and becomes a part of the horn. It furnishes a good illustration of the recognized fact that the horns of the Antilocapridæ as well as of the Bovidæ are but a modified form of hair growth.

Near the base of this horn, on the side opposite the point, is a swelling with a little naked knob or point where the side prong is beginning to show. This knob, which has a permanent position marked by a bulge on the side of the bony horn-core, indicates approximately the middle of the anterior edge of the core. The process of ripening and hardening from the point downward toward the base is evidently long and slow, but even in this young horn there are three inches of good hard point, and evidently before the horns become fully matured to the base in mid-summer, they might be very useful for defense. They are mainly, however, weapons for the fall tournaments in which the bucks fight for supremacy.

These facts recorded while fresh in mind may add something to the already voluminous reports on this most unique of our North American mammals. Every item of information in regard to the prong-horn should be saved for the species is steadily and surely slipping away from us and unless more intelligent study of their habits and requirements are made and more effective protection than state laws have ever afforded be given them, the next generation will know them only by the written records and a few museum specimens.

SKULL MEASUREMENTS IN THE NORTHERN VIRGINIA DEER

By John C. Phillips

Several years ago it occurred to me that a large series of measurements of skulls of a selected species from a restricted area might be of general interest. In the first place, if the figures were carefully tabulated and subjected to a biometric analysis they might point out the relative values of the different skull measurements. By "relative" value I mean value to the systematist, as shown by their constancy (lack of variability). By working with sufficiently large series, it seemed that the coefficients of variability of the different skull measurements might be compared directly, one with another, and thus subjected to the acid test.

Another question was that of the maximum and minimum variation within the race or subspecies, a study of which might form a basis for comparison with other races.

It was also thought that in taking a large mammal, the actual technique of measurement was subject to less error, and as the northern Virginia deer (*Odocoileus virginianus borealis*) was the only large species available in any numbers, it was accordingly chosen.

Special care was taken to throw out any specimens that were not fully adult, and after measuring 109 skulls of males, 13 of them, having an antler length of 38 cm. or under, were discarded, as being perhaps not fully developed. The remaining 96 specimens represent, in my opinion, a selected class of adult males with antlers between 38 cm., and 72.5 cm., and an average of 47.6 cm. The type of *O. v. borealis* in the Museum of Comparative Zoology has antlers 66 cm. long. A series of skulls of females was not available.

All these deer heads came into the taxidermist shop of Mr. M. Abbott Fraser of Boston, and they were nearly all secured in the Boston market, being picked out because of their value for ornamental purposes. Practically all came from northern and eastern Maine, and possibly one or two from northern New Hampshire and Vermont. (One I am certain was from Vermont.) I am indebted to Mr. Fraser for placing this material at my disposal.

It is probable that these animals are four years old, or older, and a few showed by their worn teeth that they had about reached the extreme age limit.

A word of explanation is necessary in regard to the way the various measurements were taken.

1. Palatal length. (From back of posterior molar to gnathion.)

2. Audito-basal length. Owing to the fact that the posterior end of many of these skulls was damaged in the taxidermist shop, in process of getting out the brains, the condylion could not be utilized in taking the condylo-basal length. Accordingly I selected the anterior edge of the auditory canal as the posterior point and the gnathion as the anterior point, calling this the audito-basal length.

3. The length of lower tooth row.

4. The zygomatic width (greatest width outside zygomata).

5. The length of upper tooth row.

6. The greatest width of orbit.

7. The mastoid width (greatest width between mastoid prominences).

8. Length of nasal bones.

9. The length of antler along outer curve.

The probable error is also given in each case for the mean, the standard deviation, and the coefficient of variability.

A summary of all these measurements is given below in the form of a table, the measurements appearing in the order of their uniformity, those having the smallest coefficient of variability (C. V.) appearing first.

Under each measurement appears:

1. The number of individuals upon which the calculation is based.

2. The actual mean size of the whole series.

3. The absolute maximum size.

4. The absolute minimum size.

5. Measurement of the type of *borealis* in Museum of Comparative Zoology.

6. The standard deviation, or index of variability (see Davenport, Statistical Methods, John Wiley & Son, 1899, page 15) which gives the average deviation of all individuals from the mean.

7. The coefficient of variability (see Davenport) wherein the deviations from the mean of all the different individuals are reduced to a concrete number, which renders the different skull measurement directly comparable, one with another. This is the important figure to note, and the only one of special interest in determining the relative value for systematic purposes of the various measurements here studied.

	NUMBER OF INDIVIDUALS	MEAN SIZE	MAXIMUM SIZE	MINIMUM SIZE	SIZE OF THE TYPE IN MUS. COMP. ZOOL.	STANDARD DEVIATION, σ	COEFFICIENT OF VARIABILITY, C. V.
Palatal length	92	17.6 ±0.05	19.4	15.5	19.0	0.76 ±0.04	4.318 ±0.21
Audito-basal length	91	26.65 ±0.08	30.2	23.7	28.5	1.21 ±0.06	4.55 ±0.23
Lower tooth row, length	95	8.31 ±0.03	9.2	7.1	8.2	0.414 ±0.02	4.97 ±0.24
Zygomatic width	96	11.76 ±0.04	13.4	10.4	13.4	0.6 ±0.03	5.107 ±0.24
Upper tooth row, length	96	7.62 ±0.03	8.5	6.0	7.8	0.41 ±0.02	5.39 ±0.26
Orbit width	96	4.27 ±0.02	4.9	3.8	4.0	0.24 ±0.01	5.6 ±0.27
Mastoid width	95	9.83 ±0.05	12.0	8.4	10.3	0.696 ±.034	7.102 ±.348
Nasals, length	94	9.0 ±0.06	10.9	6.1	9.1	0.89 ±0.04	9.9 ±0.5
Antler length of adults	95	49.8 ±0.47	72.5	38.2	66.0	6.87 ±0.34	13.78 ±0.89
Antler length including 13 juveniles	108	47.6 ±0.57	72.5	21.0	66.0	8.9 ±0.4	18.66 ±1.41

Note.—All measurements in Cms.

DISCUSSION

As may be seen at a glance, the most reliable skull measurement in this species, perhaps also in the deer family generally, is the palatal length, which shows a coefficient of variability (C. V.) of only 4.318. Next, and very nearly as uniform, is the audito-basal length (explained above) with a C. V. of only 4.55. The lower tooth row is less variable than the upper, but both these and the zygomatic width are substantially of the same value and are all very uniform.

The orbit width (greatest width of orbit) is also a reliable measurement, but when we come to mastoid width, there is a very marked difference. It is possible that this C. V. (7.102) may have been slightly effected by damaged mastoids, although all those skulls which appeared to have been chipped or injured in the mastoid region were thrown out.

The nasal bones are, as might be expected, by far the least valuable character, showing nearly double the variation of the palatal length. The antler length is included merely to give an idea of the size of the individuals, and naturally shows a very great range of variation. With the 13 juveniles included (these were not included in any of the other measurements) the antler length is of course still more variable.

The value, if value there is, in this study of a series of deer skulls, lies in the fact that all specimens come from a fairly well restricted locality, and that they were all measured by myself in the same way and with the same instruments. I wish that the number of specimens could have been still greater, but as it is, it appears large enough to give a fairly reliable answer to the question of the variability of the several measurements in adult males of the northern Virginia deer. It also gives a correct idea of the extremes of size which we may expect to find in this race.

NOTES ON THE BREEDING HABITS OF CAPTIVE DEERMICE

By Ernest Thompson Seton

At Cos Cob, Connecticut, on August 22, 1905, I caught a female deermouse (*Peromyscus leucopus noveboracensis*), and put her in a large cage on my study table, so as to observe her continually. On September 15, she was found to have a nest of young—three in number and apparently newly born; therefore gestation was at least 23 days. The house mouse is said to carry for 21 days. My notes are as follows:

October 7. The young mice are three weeks old, but already half grown and very active. They are of a lead color, blended into dull whitish below. One has a weak hind leg; this one often dances; that is, whirls around and around. I once counted 12 turns right to left, then changing he made 11 turns left to right, then a dozen the other way, then a lot so fast I could not count them. This one is evidently troubled with a nervous disease, but one of the stronger ones also whirls at times. A sudden fright sometimes makes them whirl. The sickly one died when five weeks old.

October 27. The young deermice in the cage are now 42 days old and two-thirds grown. One shows a general tinge of brown on flanks and hams. The other is clearly moulting. Along each flank is a line of long unmoulted hair, on the back it is short, sleek and blue.

April 18, 1906. On my return home, after an all winter's absence, I find the old deermouse and one young one remaining. The young one, a female, is now of the same fawn color and white as the mother, but though seven months old is not quite so large, which is doubtless an individual peculiarity. They are active chiefly at night. (But two which I had later commonly came out of the nest at noon to sit for a time in the sun, which fell on their cage. This habit I have also seen in the wild ones.)

April 27. To-day for the first time I heard the deermice squeak and twitter; they seem to be quarrelling in the nest. On May 4 I put a male deermouse into the cage, and, a few days later, a second one.

May 14. The old deermouse female has ceaselessly persecuted the smaller male. To-day he got out and escaped up the chimney, leaving the older male with the two females. The little female showed signs of heat to-day and yesterday, following the old male, sniffing at his rear and nibbling his legs. To-day I gave them a convenient nesting box in the cage. The young female was wildly excited, rushing in and out, preparing a nest. The old male is heard drumming frequently.

Twice I saw him in the act; it is done with one front paw striking down on any near object, so fast that one sees a mere haze of paws for the half second that it lasts. (Later I had a male that drummed a little with his tail.) The little female made a hammering as she scratched herself with a hind foot; but I have not yet seen a female make the drumming. (Later, I kept two females for some weeks, and never once heard them drum.)

These mice often squeak shrilly while fighting with each other. (Later I noted one that gave off a succession of squeaks when caught in a trap.) These observations on the voice are of interest since M. A. Walton, who first recorded the drumming of these mice, says they are

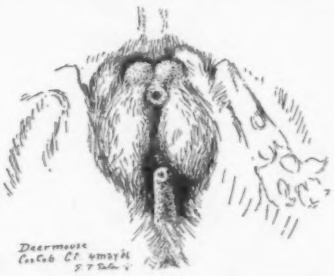

FIG. 1. EXTERNAL GENITALS OF PEROMYSCUS LEUCOPUS NOVEBORACENSIS. MALE.

One and one-half times natural size.

"completely dumb." It is always dangerous to say that an animal with vocal organs is dumb. In this case, the voice may be so high pitched that only very young, or very sharp ears can hear it.

June 4. To-day one of the mice, the younger female, is obviously near bringing forth young.

June 9. The young mice, 3 in number, were born either yesterday or the day before, so that gestation apparently is 23 days. One of them, measured June 10, was in body $1\frac{7}{16}$ inches long, tail $\frac{7}{16}$ inches. When it was left at the door, the mother nosed it, whiskered it, then carried it back to the nest. When they were 11 days old, I chanced to disturb the mother mouse. She ran out with two of the young attached to her inguinal teats. Although she ran fast, turned, twisted, climbed the bars, carried stuff to the nest and rebuilt it, they hung on, bumping along with every inequality. Later I saw her remove one of

them by force and carry it in her mouth to the nest. (I have also seen them in the woods, carrying their young both ways.) One young which I measured was, body 2 inches long, tail $1\frac{1}{16}$. It was fully haired, but eyes not open.

This same day, I put the father mouse back in the cage with the family. He at once ensconced himself in the nest, despite the mother, who fought him off a number of times, uttering meanwhile a thin twittering. He did not resist but held up his paws whenever she approached. When I removed most of the nest, he helped the mother to carry it back and pack it around themselves and the young ones.

June 21. The young still have their eyes tight closed (13th day). I examined one out in the sunlight, but saw not the beginning of aper-

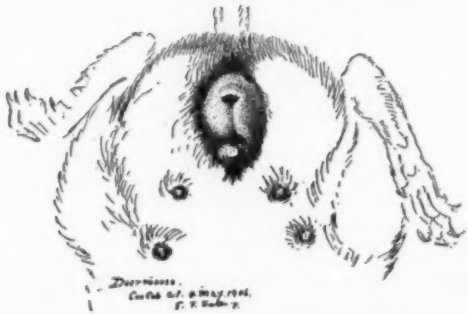

FIG. 2. EXTERNAL GENITALS OF PEROMYSCUS LEUCOPUS NOVEBORACENSIS. FEMALE.

One and one-half times natural size.

ture. They are now big and strong, and sometimes wander outside the nest. At once mother, never father, carries them back. Nevertheless, father cuddles them much when in the nest. Often they hang onto the mother's teats, when she comes out. So far it has been always the inguinal teats, never the pectoral, that are so used.

June 23. The young mice have their eyes open to-day (the 15th day). They are now about half the dimensions and a quarter the weight of the mother. They are very active and climb extremely well. I saw the tail of one projecting from the nest and gently lifted him up by it. To my surprise I also lifted his mother to whom he was attached and his two brothers who were attached to her, all by the inguinal teats. On June 26 (18th day) I saw them for the first time running

like old ones and scrambling over the bars of the cage. On July 18 (40 days old), they were completely weaned and nearly full grown.

June 6. To-day saw signs of rut in the old pair of deermice. In thirteen days the female was well advanced in pregnancy. On June 22, the 16th day, she was found with 4 new-born young tight on her teats; 3 on the inguinal, 1 on the pectoral; which may mean that I was wrong about the mating time. On the 16th day after birth, their eyes are fully opened, and they are very active.

These mice are extremely fond of nuts and can quickly get at the meat of a shellbark. But when given choice, they went first for some acorns and finished them, before touching the hickories. They killed and devoured a cicada that was put with them.

FIG. 3. MAMMÆ OF PEROMYSCUS LEUCOPUS.
Two-thirds natural size.

At another time I had but one deermouse in the cage when a meadowmouse (*Microtus*) arrived and was put in to keep him company. I watched closely fearing that they might fight, in which case I expected it would be necessary to rescue the deermouse. But it turned out otherwise.

The deermouse made one or two darts of bewildering quickness, and the meadowmouse beat a retreat. Within two days they were good friends, and made a joint nest in a curl of birch bark. Though much more intelligent than his friend, the deermouse had made little effort to escape from the cage, but the meadowmouse spent most of his time gnawing at the wooden parts of the frame. In particular he worked at the upper part where he had to cling and gnaw at the same time.

After a fortnight I set both at liberty in the woods. The meadow-mouse kept on running, dodging behind logs and sticks, using every shelter, but still running until it found a hole. The deermouse gave three or four long bounds, got behind a tree, then squatted flat on the leaves. I followed and found him. Again he got out of sight and squatted. This he did as often as I followed, until he had the luck to find a hole. When squatted on the leaves his color so closely matched them, that he was very hard to see.

Greenwich, Connecticut, October 3, 1919. Found a deermouse's nest in the tangle about 18 inches from the ground and against the side of a log. It contained 2 adults, and 2 young ones about two-thirds grown; I should say they were 6 weeks old.

October 5. Found the mother and 4 young in the nest.

October 7. Both adults in the nest to-day and, with them 5 young in gray pelage.

October 8. Last night for the first time it was very cold. Our first touch of frost; this morning the nest was empty.

October 9. Mild once more; 4 young in the nest this morning.

October 10. Dull and warm. The mother and her brood in the nest this morning.

October 11. Mother and young in nest.

October 13. Frost last night, the nest empty. Found a young deermouse drowned in a well 50 feet away.

October 14. One young deermouse in nest to-day.

October 16. Warm night, one old deermouse in nest; one young fished alive out of the well (one drowned there on 13th); a third found wandering alone 40 feet from the nest. Maybe all are of the same brood.

October 17. Sharp frost again last night. The deermouse nest deserted finally.

These observations seem to show first, that both parents take part in caring for the young; which implies that the species is strictly monogamous. Second, that they have more than one nest, and these are suited to different kinds of weather; this habit is known also among squirrels.

As a concluding item, a note from my journal of October, 1904: I found a deermouse's nest among some old carpets in an outhouse. It had an unpleasant smell; when opened it contained three tiny young ones, apparently new-born, dead and dried up, and with these the dead body of the mother at the moment of maternity with another young one. Mere fragments of evidence, but enough to bring a sympathetic tear to the eye of one who knew the mother's pain.

GENERAL NOTES

HOY'S SHREW IN LABRADOR

In a collection of mammals made some twenty years ago by Mr. Jewell D. Sornborger, and later acquired by the Museum of Comparative Zoölogy, Cambridge, is a single specimen (M. C. Z. 13444) of Hoy's shrew (*Microsorex hoyi*), a species not hitherto recorded from Labrador. It was captured in 1898 at the Moravian mission settlement of Hopedale on the northeast coast, and so considerably extends the known range of this boreal species. A careful comparison of the skin with other specimens from Quebec and Alberta does not reveal any notable differences in color or proportions. I am indebted to the Museum authorites for the opportunity of publishing this interesting record.

—*Glover M. Allen.*

A BAT NEW TO THE JAPANESE FAUNA

On his last expedition to the East in search of new or interesting woody plants for the Arnold Arboretum, Mr. Edward H. Wilson captured a small bat on the island of Yaku (Yakushima) which lies some ninety miles south of Kagoshima on Kiushu, the southernmost of the large Japanese islands. This specimen in alcohol, Mr. Wilson has kindly presented to the Museum of Comparative Zoölogy, to the authorities of which I am indebted for permission to record it here. It proves to be a species of *Murina*, apparently identical with *M. ussuriensis* lately described by Ognew (Annuaire Mus. Zool. de l'Acad. Imp. Sci. St. Pétersbourg, 1913, vol. 18, p. 402, pl. 12). This author bases his description on two specimens from Ussuri-land, eastern Siberia, the first a female captured April 23, 1910, at Dorf Ewseeivka, Kreis Imansky; the second captured August 13, 1913, at Odarka, Chanka Lake. Mr. Wilson's specimen is therefore the third to be recorded, and extends the known range of the species some fifteen degrees of latitude southward. It was captured in February and may therefore have been a migrant from the inhospitable winter climate of Ussuri and northern Manchuria to the warmer islands of southern Japan. The following measurements indicate close agreement in size, nos. 1 and 2 being respectively the first and second of Ognew's specimens, no. 3 the one here recorded:

	1	2	3
Total length (about)	68.5	73.2	72
Forearm	31.2	32	32.6
Tibia	15.8	16.4	16.5
Greatest length of cranium	16	15.7	16.7

Hitherto *Murina hilgendorfi* Peters was the only species of the genus known from Japan (see Aoki, B., "A hand-list of Japanese and Formosan mammals," Annot. Zool. Japon., 1913, vol. 8, p. 287). It is a considerably larger species (forearm 43 mm.) but with much the same general proportions. Its skull, however, has a low sagittal crest while that of *M. ussuriensis* is smooth.

—*Glover M. Allen.*

FOOD OF THE RED FOX

On January 21, 1920, I was following a large fox track through the woods, where the animal had been hunting in leisurely fashion. On coming to a high stone wall he had leaped up on it, and there dropped dung. The four pellets were rather small, soft, smooth and of a dull green color, but there was no sign of fruit or hair on the outside. I sent the mass to the Biological Survey for examination, and received the following report: "The pellets were composed of about 90 per cent. mouse fur, mainly of *Microtus pennsylvanicus*. There were a few bones of the mice, one small feather of a bird, probably a chicken, and some skins and seeds of apples. The green color over the outside and to some extent throughout the felted mass is undoubtedly from the stomach contents of the *Microtus*, which would be mainly grass. I should think from the amount of fur, that 10 or a dozen mice were represented in this lot." (Bailey). As there was about two feet of snow on the level one wonders how he got at the mice.

—*Ernest Thompson Seton.*

Greenwich, Conn.

ACROBATIC SKUNKS

Arthur H. Howell's note on *The Spotted Skunk as an Acrobat* prompts me to write that this performance of standing on the front feet with hind feet up in the air is one that I have seen many times in the big northern skunk (*Mephitis putida*). Among several hundred skunks I found many that never did it, one or two that did it occasionally, and one that did it so much that his name with all the children was 'Johnny-Jump-Up.' It was usually done in a sort of playful threatening. He would stamp with his feet, run forward two or three paces, give a hard stamp with his front feet, and throw his hind quarters straight up in the air, with tail hanging forward and down or to one side. He always seemed to be in a rollicking good humor when he did it. I tried several times to photograph him in the act, but failed.

—*Ernest Thompson Seton.*

BOBCATS AND WILD TURKEYS

During a visit to northeastern Arkansas in the first week of February, 1920, I was told by several hunters that the high prices commanded by furs were stimulating the trappers to such an extent that bobcats (*Lynx rufus*) were getting scarce, and the immediate result of that was a marked and steady increase of wild turkeys.

—*Ernest Thompson Seton.*

THE WOOD RAT AS A HARVESTER

In December, 1916, while engaged in securing data for a report on some mineral lands near Magdalena, New Mexico, a small mining town 20 miles west of Socorro, I was surprised at the large shipments of pine nuts that were being sent to market from that station. A few miles west of Magdalena there is a considerable growth of piñon pines that might furnish a large harvest of nuts, but knowing the natural

distaste on the part of the Mexican inhabitants for manual labor between meals, I was puzzled to account for the wagon loads that they were daily bringing to market.

I was told that eight car loads had been sent to the eastern dealers, at that date, and as many more were expected before the end of the season.

Upon inquiring of the Mexicans, as well as the American merchants, I learned that the nuts were all secured from the store houses of the wood rat. Armed with an iron hook, about three feet in length, for removing the top of the nest, the Mexican nut hunter seeks the cactus thickets in the neighborhood of the pines. The nests and storehouses of the wood rat are usually placed in the shelter of the chollo cactus, if any are about, and thus protected are comparatively safe. The dome-shaped collection of sticks, dead cactus, and in fact everything movable within a hundred feet of the nest, is the retaining wall of a store of nuts, of from a quart to five gallons; the man securing in a few moments what he might pick up from the ground, under the pines, in a day's work. I was told that this store would be renewed within a week and the same rat pay rent, perhaps as many as five or six times during the fall and winter.

I think that the storehouses are always separate from the nests, and at times are at quite a distance from nests that are occupied. As I was unable to take any specimens, owing to the short time I was in this section, I am unable to say with certainty just what species of wood rat is found in the locality.

—*A. W. Anthony.*

MICROTUS TOWNSENDI IN THE CASCADE MOUNTAINS OF OREGON

All the records for the Townsend vole seem to be from the lower river valleys of western Oregon and Washington, and, indeed, the species has seldom been recorded except from localities situated on or close to tidewater. During July, 1919, I secured a series of fifteen specimens at Prospect, Rogue River Valley, Oregon, that are referable to this race, as well as a number of *Microtus mordax*, and one individual that seems to be *Microtus richardsoni arvicoloides;* but the skull of the latter has disappeared and I cannot be certain.

The middle reaches of the Rogue River flow through a dry country with summer temperatures that may reach 110 degrees, and I feel satisfied that this arid territory is an effective barrier to the continuous distribution of most of the forms that are characteristic of the humid coast belt. Prospect is at an elevation of about three thousand feet, and there is a fairly strong infusion of Transition elements in the surrounding country, but there is a pronounced change in the flora of the slightly lower country a couple of miles to the westward, and I believe that its chief tendency is Boreal. *Vulpes*, *Evotomys*, *Eutamias senex* and *Lepus washingtonii klamathensis* are a few of the forms that occur here, and in the small patch of alsike clover that was swarming with the *Microtus*, I took such Canadian species as *Zapus pacificus* and *Neosorex bendirei*. Taking all these points into consideration, it seems likely that the range of *Microtus townsendi* is interrupted between the coast and the mountains. Although there are no high mountains in the immediate vicinity of Prospect, the region rises in a remarkably even slope to the lofty peaks of the Cascades, and this vole may be expected to occur in areas that are subject to similar climatic influences on the western slopes of the Cascades, north as far as the Columbia River gap.

Specimens of *Microtus townsendi* from Prospect differ from coast examples kindly loaned me by the Bureau of Biological Survey, and assumed to be typical, in having the feet and tail darker, and in being of a grayish rather than brownish shade, while the coloration is darker mid-dorsally. The foramen magnum is smaller with less pronounced superior notch, the interparietal is smaller transversely, the molariform teeth project more beyond the alveoli at all ages, the median spread of the nasals is less abrupt, and the antero-superior portion of the zygomatic root of the maxilla is less angular. The material at my disposal indicates that the Prospect animals may be smaller than typical. These differences are mentioned as being of interest when considered in relation to the distribution of the species, but are not deemed sufficiently pronounced to merit subspecific recognition.

—*A. Brazier Howell.*

Berkeley, California.

DEPRESSIONS FOUND ON MOOSE TRAILS AND THEIR SIGNIFICANCE

During the summers of ten years the writer has travelled extensively in the remote parts of northern Ontario and Quebec where moose are plentiful. In 1919, he had the opportunity of observing moose in a district where the lowlands between the rock hills were of sand, silt, and clay instead of the moss bogs or

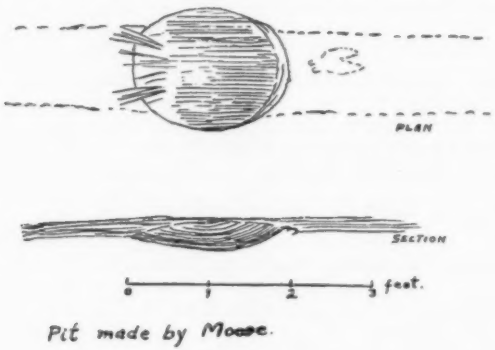

FIG. 1.

muskeg which are so common. Through the forests in this section, the moose trails were more distinct than in the muskeg, and in the moist silt and clay the tracks were sharply defined. During the months of May, June, July, August, and the early part of September nothing unusual was noted along these trails.

On the night of September 21, 1919, while sleeping in a prospector's cabin, the writer was awakened by a moose-call. The sound seemed to come from a point

near the creek about 200 feet away. Noises made by twigs breaking, bushes rustling and a variety of grunting noises continued to come from that locality for about half an hour. Then two moose were heard to walk close by the cabin and away toward the north. Next morning, upon going to the creek, a moose trail was followed to the place from which the noises of the night had come, and in the middle of the trail, surrounded by a small area of trampled bushes was a peculiar, freshly-formed, pit. This pit is the feature of special interest described in this statement.

The soil on the trail was of clayey silt softened by the rains of the previous days. The pit was elliptical with diameters of about 2 feet and 18 inches; it was 2 inches deep near the center. Moose tracks were abundant in this vicinity and there were several at one side of the pit which showed that the hoofs had slipped in the mud. The inside of the pit was covered with fine parallel striations, and a few moose hairs occurred on its surface. From a study of the pit it was possible to determine that it had not been made by pawing or rolling but that it had been made by the *body* of the moose sliding in the mud.

Subsequently, the main moose trail which led north from this point was followed; and at a distance of 10 chains a similar pit was found. The next day two other pits of similar character were observed on moose trails, one being in sand and not distinctly marked as were those in clay.

A local hunter was shown some of these pits and asked what they meant. He supposed that they indicated the site of a combat between bull moose. He stated that he had never observed them at any other time of the year than the late fall. He had not previously noted the striated surface of the pits nor the lack of a second one which would presumably be formed if two animals opposed their horns and pushed.

The writer advances the suggestion that these depressions are formed by moose during copulation. Such a structure would be the obvious result if the animals follow the procedure of cats, the female lying down.

—*T. L. Tanton.*

Ottawa, Canada.

BREEDING OF THE BRAZILIAN TAPIR

The following breeding record of a pair of Brazilian tapirs (*Tapirus terrestris*) in the collection of the National Zoological Park covers a period of 16 years. The male was obtained at Manaos, Brazil, in the spring of 1899, by Commander C. C. Todd, U. S. N., while in command of the U. S. Gunboat Wilmington during her voyage up the Amazon. The female, which was bred and reared in the botanical gardens at Demerara, arrived at the Park in August, 1901. The male was about one year old, and the female probably between 3 and 5 years, when received.

The first birth from the pair occurred May 15, 1903, and the young came rather regularly thereafter, the record being as follows:

May 15, 1903; male;	period	of	gestation,	uncertain
November 7, 1904; female;	"	"	"	"
June 27, 1906; male;	"	"	"	405 days
October 13, 1907; male;	"	"	"	395 "
February 28, 1909; male;	"	"	"	401 "
July 11, 1911; female;	"	"	"	392 "
May 23, 1913; male;	"	"	"	403 "
August 4, 1915; male;	"	"	"	396 "
February 22, 1918; female;	"	"	"	404 "

While there is, in two or three cases, a little uncertainty as to the exact time of breeding, 400 days may safely be taken as the average period of gestation. For the single birth from another pair the period was 401 days.

The death of the male, September 17, 1917, closed the record, though it is probable that the female would have bred further, as she is still in vigorous health.

Two of the young tapirs died, one from enteritis and the other as result of an accident. The rest, when from 9 months to 2 years old, were disposed of in exchange for other animals.

—*A. B. Baker.*

THE FUR SITUATION

The largest sale of furs which ever occurred took place in St. Louis during the first half of February, 1920. In the course of 12 days peltries to the value of $27,000,000 were disposed of. A week or two later a similar auction sale of somewhat less extent occurred in New York. Next May a third auction sale of furs will be held in Montreal. Thus it appears that we have in North America three distinct corporations handling furs extensively.

The center of the world's fur trade is now beyond question located in America. Only a few years ago London was the main fur center of the world. Leipzig and Moscow were its satellites. Prior to 1914 the bulk of American raw furs were transported across the Atlantic, sold, dressed, dyed, and resold in London and other European centers. Many of them were finally brought back to this country to be worn out. Now all this is changed. The raw furs produced in America and many brought from other parts of the world are sold at American auctions to American dealers, and dressed, dyed and manufactured in American establishments for American and foreign trade.

While St. Louis is the greatest sales center, New York City is the center of fur dressing, dyeing and manufacturing. In greater New York there are approximately 18,000 people engaged in the various branches of the fur industry. About 500 of these are dealers. The capital invested there has been estimated to be about $200,000,000. The number of dressing and dyeing establishments in New York in 1918 was about 60. They handled in that year a total of more than 39,000,000 skins.

A National conference on the fur industry and wild life protection in Canada was held at the Windsor Hotel, Montreal, February 19 and 20, 1920, under the auspices of the Commission of Conservation and the Advisory Board on Wild Life Protection. The program consisted of papers and addresses followed by discussion on the following subjects:

The Fur Industry Convention and what it may accomplish.
Our fur bearing animals: their economic significance and future.
Problems of fur production, including the care and management of foxes, nutritional problems, parasites, diseases, fox raising as a commercial proposition, raising and feeding foxes, and fur farming in Quebec.
Registration of silver foxes.
Rearing fur bearers other than silver foxes.
Fur statistics relating especially to the annual fur output of the Province of Quebec.
Marketing furs, including improvements of methods of marketing, trade names of furs, and a Canadian auction fur sale.
Game laws and administration, including the sale of game, game protective associations, and a discussion of game laws from the standpoint of the legislator, the trader, the trapper, the fur dealer, and the fur manufacturer.

While this meeting was attended mainly by Canadians a number of Americans were present also. The papers and subsequent discussion disclosed the fact that Canadians evidently feel that the fur resources of their country are of prime importance. The annual returns from furs outweigh those from game.

—*N. Dearborn.*

A SUPPLEMENTARY NOTE ON CLEANING SKULLS

Experience at the Museum of Vertebrate Zoology indicates that after placing fresh skulls in a seventy per cent solution of alcohol it is better not to take them out again until one is ready to clean them. Be sure that the alcohol used has not been denatured with formalin, or the skulls will be very much harder to clean. Instead of cooking the skulls in an open pan, try cooking them in a covered, double boiler for a considerably longer period.

—*A. Brazier Howell.*

RECENT LITERATURE

Hinton, Martin A. C. REPORT ON THE HOUSE RATS OF INDIA, BURMA, AND CEYLON. Journ. Bombay Nat. Hist. Soc., vol. 26, pp. 59–88, December 20, 1918, and pp. 384–416, May 20, 1919.

After studying the very large series of house rats obtained by the Mammal Survey of India together with the Indian material in the British Museum Mr. Hinton concludes that of the 21 known Indian, Burmese and Ceylonese forms no less than 17 (12 new) are subspecies of *Rattus rattus*. His general observations on these subspecies are of unusual interest. "Turning now to India," he says (pp. 65–68) "the rats listed in the Survey Reports as '*rufescens*,' or '*rufescens* var.', afford us with problems of considerable complexity. In the first place, although I am unable to find any character in the dentition, skull, or external parts, to distinguish any of them satisfactorily from *R. rattus*, the range of variation is enormous. Indian skulls with well worn teeth have the condylo-basal length ranging between 34 and 44 mm. The fur may be long, soft, dense and without spines; or it may be short, thin, and harsh, with numerous spiny bristles. The dorsal colour varies between bright rufous, or warm olivaceous tints on the one hand, to dull tawny, or cold mixtures of black and grey on the other. The underparts may be pure white or pale lemon; or they may be slaty, with or without a rusty tinge or bloom. The hands and feet may be white or yellowish above, with or without dusky markings; or they may be wholly blackish brown in colour. The mammary formula may be 2–3=10 or 3–3=12. Every intermediate stage between the extremes indicated may be found in the collections before me. Nevertheless, much of this variation has a definite geographical value; and where long series are available from one locality or district, the rats are usually found to conform closely to one or more definite local types. It is therefore possible to define a considerable number of local races or subspecies.

The members of the *rattus* group seem to afford an exception to the rule, so general for wild mammals, that not more than one subspecies of a given species, or not more than one of two or more very closely allied species can inhabit a given locality. But these rats are capable of playing many parts in warm countries; thus we find them following a free life in fields and hedgerows, far from houses, or high up among the branches of trees in forests; or they may lead a purely parasitic existence in human habitations or shelters. It is a poor sort of locality which refuses at least two "niches in nature" for *rattus;* and the semi-domesticated stocks, at all events, of this species have frequent opportunities for prospecting and touring conferred upon them by railways, wheeled carriages, and shipping.

Like other murines, this species shows, within certain limits, an almost startling plasticity. Its structure responds readily to the demands of purely local requirements. If necessary colour or the quality of the coat are modified; a change in diet induces modifications in the development or the "set" of the muscles of mastication; and these in turn mould the skull, or lead to the lengthening or shortening of the tooth-rows.

Considerations such as those mentioned in the preceding paragraphs lead us to realize the hopelessness of attempting to disentangle the history of the rats in large towns or ports like Calcutta or Bombay. In such places the rat population

is a motley horde, representing the progeny of truly native rats crossed with the descendants of old wanderers and with newcomers not only from the neighbouring hinterland but from all parts of the world. It is therefore only in the more remote parts of the country that we can reasonably expect some measure of success to crown such efforts. . . . .

Mr. Wroughton has already brought before the Society (*J. B. N. H. S., Vol.* XXIII, p. 474) the view that the white bellied forms of *R. rattus* in India and Burma represent the primitive wild form of the species; and that the dark bellied types are parasites, the darkening of the underparts, no less than the darkening of the back, being the outward indication of domesticity or parasitism. In support of this view, one may point to the general similarity of the Indian white bellied forms to the wild race, *R. r. frugivorus*, of the Mediterranean region; to their wide distribution, both in the mountains and in the plains, in India and Burma: and to the wild life which many of them lead in the jungles. Further on investigating these white bellied rats in detail, we find that they behave very much as do normal wild mammals as regards geographical variation and that it is therefore possible and comparatively easy to arrange them in geographical races or subspecies.

With regard to the dark bellied rats the case is different. They are largely restricted to districts possessing substantial houses; they are more frequently caught within doors and far less frequently in the open. Close investigation of their structure leads to nothing but confusion; the variation is largely individual or colonial, and scarcely at all geographical. In some districts, as in Kumaon, such rats seem to have little or no connection with the white bellied forms; in other places, they differ from their white bellied companions merely in colour and to a trifling extent in skull—the cranial differences being readily susceptible of a physiological explanation, ...; finally, in still other districts, the difference is purely one of colour and even that sometimes breaks down. One concludes from this that the dark bellied rats are of diverse origin; some seem to have been produced, in the localities where they are now found, from the local white bellied race; others have found their way to their present habitations from other more or less remote districts of the country, or even from abroad; and lastly, many are doubtless to be regarded as the mixed descendants of both native and imported stocks."

It will readily be seen that the interrelationships of these rats presents a complicated problem and one which is rarely met with among mammals. Of particular importance is Mr. Hinton's suggestion that, in the *Rattus rattus* group, distinct subspecies are probably being developed in different "niches in nature" at single localities. While the facts now at hand may not be sufficient to prove the occurrence of such development among the rats under discussion they clearly indicate the possibility that it is taking place. Something of the kind must be assumed as the first step in establishing lines of "local adaptive radiation," a process which appears to have exercised great if not dominating influence throughout the evolutionary history of all mammals. At present, however, this process is known from its later or finished results only; its earlier stages have not been demonstrated. Detailed observations on the living house rats of India in their natural surroundings are therefore much to be desired. A clear understanding of the early stages of adaptive radiation might be one of the results.

—*G. S. Miller.*

Cabrera, Angel. GENERA MAMMALIUM. MONOTREMATA, MARSUPIALIA. Madrid, Museo Nacional de Ciencias Naturales, pp. 1–177, pls. 1–19, many figures in color. 1919 (Received in Washington October 6).

The appearance of the first part of Cabrera's *Genera Mammalium* marks the beginning of a work which, if completed in the same manner that it has been begun, will be the most important publication on mammals since Trouessart issued his *Catalogus* twenty years ago. The author has had long experience in the analytic study of his subject; he now shows his ability in synthesis. Those who are acquainted with the literature of mammals will appreciate the degree to which this combination of qualities is rare.

"The plan which I have followed," Mr. Cabrera writes in his preface (freely translated), "is the same as that of the well known *Genera Insectorum of* Wytsman, a plan which has appeared to me the most satisfactory on account of its conciseness and clearness. In imitation of the procedure followed in this monument of entomological literature I omit keys to the species, limiting myself to enumerating these alphabetically and distinguishing them by serial numbers; the same is done under each species for the subspecies, which are designated by Greek letters. I recognize that my book is, rather than the result of personal investigation, a simple work of compilation. If there is anything good or useful in it this will be the material which I have taken from others. My task, more mechanical than anything else, has merely been to assemble this material. The errors which may have slipped in will, I hope, be pardoned by the reader in view of the abnormal conditions which humanity is subjected to at this time and which have made it difficult to procure certain references and details that would have contributed toward greater completeness."

The text is entirely in Spanish. It consists of a series of diagnoses and keys (strictly dichotomous and clearly expressed; I have not yet had the opportunity to test them with specimens), covering all groups from order to subgenus. Synonymies and distributions are given under genera, subgenera, species and subspecies; a bibliographical paragraph is included in the account of each family. Other subjects formally treated are: history (under families), habits (under families), reproduction (under families), paleontology (under families), types of recognized genera and subgenera, and derivation of the accepted generic and subgeneric names. Mr. Cabrera's work has been done with great care, thoroughness, and skill, so that errors, typographical and other, are conspicuously infrequent. The omission may be noted of *Leucodidelphis* (von Ihering, Revista Mus. Paulista, vol. 9, p. 347, 1914) under the genus *Didelphis* and of the very important *Eodelphis* (Matthew, Bull. Amer. Mus. Nat. Hist., vol. 35, p. 477, July 24, 1916) in the account of the paleontology of the family *Didelphidæ*. Three new genera are described: *Minuania* (type, *Didelphis dimidiata* Wagner), *Holothylax* (type, *Didelphis opossum* Linnæus), and *Amperta* (type *Chætocercus cristicauda* Krefft). The plates were drawn by the author. While the figures of skulls and teeth seem to be entirely satisfactory the reproduction of the colored drawings leaves much to be desired; obviously in most instances justice to the originals has not been done.

There are three features in the plan of the book which might be altered to the advantage of future parts. The scale of reduction or enlargement could be indicated by a symbol placed after the number of each figure on the plates, a table

of contents could be added in which the classification adopted would be shown in synoptic form, and the extinct members of the group could be given their proper place in the general text if not in the keys. At present the fossils are cursorily mentioned in the paragraph headed Paleontology as part of the general account of each family. Hence such fossils as represent families of their own, like *Diprotodon* or *Nototherium*, entirely escape notice. Furthermore, such names of fossils as do occur in the text are not included in the index and are not accompanied by references. This failure to treat the extinct forms in the same manner as those now living is a surprise in view of the comprehensive title *Genera Mammalium*. It is the only serious adverse criticism to which the book appears to be open. But unfortunately it too often happens at present that mammals preserved in rock are treated and thought of as essentially different from those preserved with arsenic or alcohol.

As a book the volume has the attractive character which comes from well selected type, well arranged paragraphs, and well margined pages. It reflects credit on the National Museum of Spain and on the "Junta para ampliación de estudios é investigaciones científicas" under whose auspices it is published.

—*G. S. Miller.*

Lönnberg, Einar. Remarks on some South American Canidæ. Arkiv för Zoologi, Stockholm, vol. 12, no. 13, pp. 1–18, figs. 1–4. Printed September 3, 1919.

Dr. Lönnberg describes and figures the skull of *Pseudalopex lycoides* (Philippi), basing his account on three specimens collected on the eastern pampas of Tierra del Fuego by Ohlin during Nordenskjöld's expedition of 1895–6. While resembling the skull of *P. magellanicus* from the neighboring mainland in form it is decidedly larger, agreeing with that of the *P. peruanus* (Nordenskjöld) found in a cave near Tirapata on the Peruvian plateau. The Peruvian animal was a contemporary of *Onohippidium*, *Scleridotherium* and other extinct mammals. Apparently it has survived with little or no change on Tierra del Fuego while another species has replaced it on the continent. Such a history would parallel that of microtine rodents now inhabiting Guernsey and the Orkney Islands.

The skull of a domestic dog, probably pure bred, obtained from a party of Yaghan Indians on Tierra del Fuego is also described and figured. It shows no resemblances to any of the known native South American Canidæ, but essentially agrees with the pre-Columbian dogs of Peru. In discussing the characters of this specimen Doctor Lönnberg remarks: "That the so-called domesticated dogs are of polyphyletic origin is nowadays generally admitted". Prevalent though this belief may be it probably rests on no secure basis of facts. Superficial resemblances, in general form, in color, and in quality of fur, to jackals, coyotes, foxes and other wild members of the family may not infrequently be seen in domestic dogs. But in all the specimens that I have examined, representing very diversified breeds, the skull and teeth remain fundamentally true to the type which in wild canids is peculiar to the northern wolves. This type, particularly as regards the cheekteeth, does not represent a primitive condition which might be expected to occur in various members of the family without having any special significance. On the contrary, in respect to the development of a combined cutting and crushing type of carnassials and molars it is the most

highly specialized now in existence. It is, as I have said, not known outside of the restricted subgenus or genus *Canis*. Dogs which were certainly not carried by modern Europeans accompany native man in many parts of the world, Africa, Malaya, Australia and South America, for instance, where no true *Canis* is known to occur now or to have occurred in the past, and all of them apparently retain these generic or subgeneric characters uncontaminated by those of their local relatives with which they have been brought in contact. The best explanation of all these conditions seems to be that dogs were originally domesticated somewhere within the northern area inhabited by true *Canis*, and that they were subsequently taken by man to most of the regions into which he has penetrated. Wherever dogs and wild *Canis* in the restricted sense occur together crossing may take place, and by this process many, possibly all, local forms of the wolf have perhaps contributed to the peculiarities of domestic races. At present, however, there seems to be no satisfactory evidence of polyphyletic origin of any other kind.

—*G. S. Miller.*

Neuville, H. De l'Extinction du Mammouth. L'Anthropologie, Paris, vol. 29, pp. 193–212, figs. 1–3. July, 1919.

Few ideas regarding the natural history of mammals are more generally accepted than the belief that the Siberian mammoth was specialized to withstand the hardships of life in a cold climate. As a result of histological study of the skin of two specimens in the Paris Museum Mr. Neuville, however, comes to the conclusion that, far from being fitted to bear extreme cold, the mammoth disappeared mainly because the peculiarities of its integument prevented this necessary adaptation. The skin was covered with dense fur. But the power of fur to resist cold and dampness depends on the presence of the oily substance secreted by the sebaceous glands, and these glands, as they now are in the living elephants, were absent. Snow, sleet and rain could penetrate such fur to the base and "transform it into a veritable mantle of ice." Other peculiarities of the Siberian mammoth which placed the animal at a disadvantage were the great size and unserviceable form of the tusks, the absence of a protective horny thickening of the epidermis, such as occurs in the living elephants, and the tendency of the soles, especially of the hind feet, to throw out horny excrescences which resembled those occasionally seen in menagerie elephants and which must have seriously impeded locomotion. Mammoths probably flourished in Siberia at a time when the forests extended to and beyond the Arctic coast. Their physical limitations were such that they were unable to adapt themselves to the climatic changes which brought on the recession of the forests and the establishment of tundra conditions. With the development of these conditions they therefore gradually became extinct.

Mr. Neuville discusses many subjects that are of general interest: the use of the tusks in the living elephants, the establishment of the thickened horny epidermal layer of the skin through an adaptive process which was probably at first pathological ("the skin of the adult elephant forms a vast corneous papilloma"), the function of sebum and sweat, individual variation in the number of toe nails in elephants, the variable size attained by adult Siberian mammoths, former ideas regarding the causes of extinction.

While it seems probable that the factors enumerated had much to do with the final disappearance of the Siberian mammoth it must be remembered that this disappearance was only one phase of the general elimination of proboscidians that took place during the Pleistocene. At about the beginning of this epoch these mammals probably occupied essentially the whole of the continental area of both hemispheres. At its close they had disappeared in America and had become restricted in the Old World to the regions now inhabitated by the Indian and African elephants. Throughout the world the group was dying from old age as so many groups of vertebrates had died before. At such a time conditions might undoubtedly prove fatal which would cause no injury to a younger more vigorous stock.

—*G. S. Miller.*

Anderson, Rudolph Martin. Field study of life-histories of Canadian mammals. Canadian Field-Nat., vol. 33, November, 1919, pp. 86–90. January 3, 1920. (A plea for systematic studies of habits of the mammals of Canada.)

Anthony, H. E. Mammals collected in eastern Cuba in 1917. With descriptions of two new species. Bull. Amer. Mus. Nat. Hist., vol. 41, pp. 625–645, plates 35–37. December 30, 1919. (New: *Nesophontes longirostris* and *Natalus primus*, both described from remains found in a cave near Daiquira, and supposed to be extinct.)

Bannon, Arthur H. A spring bear hunt in Cassiar. Forest and Stream, vol. 89, pp. 151–155; 184–186. April, 1919. (Account of bear hunting on the lower Stikine and the Clearwater in May and June, 1918.)

Barber, W. E. Interesting facts concerning the beaver. Wisconsin Conservationist, vol. 1, no. 4, pp. 2, 3. September, 1919. (Notes on habits, and mention of a beaver house in Bayfield County, Wisconsin, 16 feet high and 40 feet broad at base.)

Bowles, J. Hooper. The California gray squirrel an enemy to the Douglas fir. Amer. Forestry, vol. 26, p. 26. January, 1920.

Boyle, Una. River otter plays on moonlight nights. California Fish and Game, vol. 5, no. 2, p. 98, April, 1919. (Observations at Lake Leonard, Mendocino County, California.)

Brimley, C. S. Our rats, mice and shrews. Journ. of Elisha Mitchell Scient. Soc., pp. 55–60. October, 1919. (Popular descriptive account of the species occurring in North Carolina.)

Brooks, Charles E. P. The correlation of the Quaternary deposits of the British Isles with those of the continent of Europe. Ann. Rep. Smithsonian Inst., 1917, pp. 277–375. 1919. (Numerous records of fossil mammals.)

Buxton, Cara. The "gadett" or brain-eater. Journ. East Africa and Uganda Nat. Hist. Soc., no. 15, p. 498. November, 1919. (Note on the killing of sheep for the brain alone by the spotted hyena; the bodies of the destroyed sheep remain untouched.)

Cheesman, R. E. See Wroughton, R. C., and R. E. Cheesman.

Crewe-Read, R. O. Ant-bear. Journ. East Africa and Uganda Nat. Hist. Soc., no. 14, pp. 421–422, 1 plate. July, 1919. (Specimen captured near Naivasha Station, British East Africa.)

DUGMORE, A. RADCLYFFE. Marvels of beaver work. Country Life, vol. 36, no. 2, pp. 48–51, 11 figures. June, 1919.

EMERSON, GERTRUDE. Chipmunk friends. Country Life, vol. 36, no. 5, pp. 104–108. September, 1919.

FIGGINS, J. D. Description of a new species of caribou from the region of the Alaska-Yukon boundary. Proc. Colorado Mus. Nat. Hist., 3 pages and 2 plates, unnumbered. December, 1919. (*Rangifer mcguirei* sp. nov., from Kletson Creek, a tributary of the White River, four miles east of the international boundary, Yukon. The various issues of these Proceedings should have serial and page numbers, so that they may be properly cited.)

FISHERIES SERVICE BULLETIN No. 53. October, 1919. Sale of furs from Pribilof Islands. (Notice of sale of 9,055 skins of fur seal, 665 blue fox, and 30 white fox for government by Funsten Bros. and Co. at St. Louis, p. 1.)

FISHERIES SERVICE BULLETIN No. 55. December, 1919. Sale of seal products. (Sale of oil and fertilizer, by-products of carcasses of fur seals killed for pelts, on Pribilof Islands, p. 1.)

FROST, RAY. A deer hunt in the Black Hills. Forest and Stream, vol. 89, pp. 519–521, 554, 556, 558, 560–561. October, 1919. (Account of hunting deer in the Black Hills, South Dakota.)

GIDLEY, JAMES W. See Miller, Gerrit S., Jr. and James W. Gidley.

GRANT, D. K. S. Game-netting in Uzigua. Journ. East Africa and Uganda Nat. Hist. Soc., no. 14, pp. 403–407. July, 1919. (Methods employed in hunting the smaller antelopes in German East Africa.)

HAAGNER, A. K. The Rhodesian baboon (*Choiropithecus rhodesiae*, Haagner). South African Journ. Nat. Hist., vol. 1, pp. 172, 173; pls. 10, 11. 1919. (Supplementary description of this species, which was first named in the same journal, vol. 1, p. 83, May, 1918.)

HAUSMAN, LEON AUGUSTUS. The microscopic identification of commercial fur hairs. Sci. Monthly, 1920, pp. 70–78, figs. 1–27. January, 1920. (Gives characters by which dyed or misnamed furs may be identified from the hair structure.)

HELLER, EDMUND. Mount Lololokwi the unknown. Harper's Mag., vol. 140, pp. 147–160, 9 figs. January, 1920. (Interesting account of a trip to Mount Lololokwi and Mount Gargues, British East Africa, in 1911, when several new species of mammals were discovered by the author.)

HELLMAN, MILO. Dimension versus form in teeth and their bearing on the morphology of the dental arch. Internat. Journ. Orthodontia and Oral Surgery, vol. 5, no. 11, pp. 3–39 of reprint, figs. 1–22. November, 1919. (Comparison of dental arch in man with that in other mammals, especially the anthropoid apes. Form of arch not determined by size of teeth.)

HEWITT, C. GORDON. The coming back of the bison. Nat. Hist., vol. 19, no. 6, pp. 553–565; 13 figs. December, 1919. (Brief history of the destruction of this animal, and an account of its present status.)

HINTON, MARTIN A. C. The subspecies of *Paraxerus flavivittis*, Peters. Ann. and Mag. Nat. Hist., ser. 9, vol. 5, pp. 308–312. March, 1920. (New: *P. f. exgeanus* from Kilwa Kisiwani, "ex-German East Africa"; and *P. f. ibeanus* from Mombasa.)

HINTON, MARTIN A. C. Three new subspecies of *Spalax monticola*. Ann. and Mag. Nat. Hist., ser. 9, vol. 5, pp. 312–320. March, 1920. (Describes *S. m. thermaicus* from the neighborhood of Salonica; *S. m. corybantium* from Murad Dagh, northeast of Smyrna; and *S. m. captorum* from Kanghri, Asia Minor.)

HOLLISTER, N. The National Zoological Park: A popular account of its collections. Ann. Rep. Smithsonian Inst., 1917, pp. 543–593; pls. 1–46. 1919. (Mammals, pp. 544–571.)

HOLLISTER, N. Two new East African primates. Smithsonian Misc. Coll., vol. 72, no. 2, pp. 1–2. January 22, 1920. (Describes *Galago sotikæ* from Telek River, and *Lasiopyga pygerythra contigua* from Changamwe, British East Africa.)

HORNADAY, WILLIAM T. Birth of a pygmy hippopotamus. Zool. Soc. Bull., vol. 23, no. 1, pp. 10–13, 1 plate. January, 1920. (Born in the gardens of the New York Zoological Society; but through unfortunate and unavoidable circumstances died in about 32 hours.)

HORNADAY, WILLIAM T. A new game act for Alaska for the better protection and more rational utilization of Alaska's game animals. Permanent Wild Life Protection Fund, Bull. no. 6, pp. 1–45, 5 plates. New York, February 15, 1920. (Urgent and timely plea for protection of the wild sheep, moose, caribou, brown bears, and other game animals.)

JACOBSON, E., AND C. BODEN KLOSS. Notes on the Sumatran hare. Journ. Fed. Malay States Mus., vol. 7, pt. 4, pp. 293–298, pl. 5, fig. 2. December, 1919. (Records 4 specimens of this excessively rare animal. The figure is from photographs of a living example.)

KLOSS, C. BODEN. See Jacobson, E., and C. Boden Kloss; and Robinson, H. C., and C. Boden Kloss.

LÖNNBERG, EINAR. Contributions to the knowledge about the monkeys of Belgian Congo. Rev. Zool. Africaine, Bruxelles, vol. 7, pp. 107–154. 1919. (New forms: *Colobus brunneus* from Sili, upper Uele River; *Miopithecus talpoin pilletei* from Ruwenzori; *Cercopithecus ascanius katangae* from Kinda, southern Congo; *C. a. orientalis* from Kampi Simba, British East Africa; *C. brazzæ uelensis* from Poko, upper Uele; *C. leucampyx elgonis* from Mount Elgon; *C. pyrogaster* from Atene, Kwango; *C. pygerythrus katangensis* from Funda Biabo; and *Papio kindæ* from Kinda, southern Congo. *Cercopithecus ascanius orientalis* is apparently a synonym of *Lasiopyga ascanius kaimosæ* Heller.)

LÖNNBERG, EINAR. Notes on the members of the genera "Cephalophus" and "Sylvicapra" in the Congo Museum. Rev. Zool. Africaine, vol. 7, pp. 162–185. 1919. (New forms: *Cephalophus nigrifrons kivuensis* from Lake Kivu; *C. n. lusumbi* from Katanga; *Sylvicapra grimmia uvirensis* from N. W. Tanganyika; and *S. g. lobeliarum* from Mount Elgon.)

LOVERIDGE, ARTHUR. On lemurs at Morogoro, G. E. A. Journ. East Africa and Uganda Nat. Hist. Soc., no. 14, pp. 401–403. July, 1919.

LUTZ, FRANK E. Scientific zoological publications of the American Museum; summary of work on fossil mammals. Nat. Hist., vol. 19, no. 6, pp. 731–733. December, 1919. (Reviews of recent publications by Gregory, Camp, Matthew, Osborn, and Anthony.)

MAYER, F. H. See Montezuma [F. H. Mayer].

MCALLISTER, M. HALL. Elk in Shasta County. California Fish and Game, vol. 5, no. 2, p. 98. April, 1919. (Small herd observed on Pit River in November, 1918.)

MCGLASHAN, ROBERT E. After goat in Alaska. Forest and Stream, vol. 89, pp. 358, 384. July, 1919. (Account of killing of mountain goat near Frosty Bay, southeastern Alaska.)

MIGHELL, LEE. Hunting on the upper Klu'lan. Forest and Stream, vol. 89, pp. 265–267, 318. June, 1919. (Hunting mountain sheep, moose, and caribou near the Alaska-Yukon boundary.)

MILLER, GERRIT S., JR., AND JAMES W. GIDLEY. A new rodent from the Upper Oligocene of France. Bull. Amer. Mus. Nat. Hist., vol. 41, pp. 596–601, figs. 1–3, pl. 34. December 29, 1919. (*Rhizospalax poirrieri*, gen. et sp. nov.)

MITCHELL, P. CHALMERS. Official guide to the gardens of the Zoological Society of London. Seventeenth edition, with 32 illustrations from photographs of animals now or recently living in the gardens. 96 pages. London. 1919.

MOHR, E. Das Nasenfeld der Hirsche als Hilfsmittel bei der systematischen Bestimmung. Archiv für Naturgeschichte, 83 Jahrg. (1917), pp. 125–128, 1 plate. November, 1919. (The plate shows the rhinarium in twelve species of ten genera of deer.)

MONTEZUMA [F. H. Mayer]. Buffalo chips. Outer's Recreation, vol. 61, 1919: chapter 1, pp. 17–20, July; chap. 2, pp. 91–94, August; chap. 3, pp. 179–181, 225, September; chap. 4, pp. 263–265, October; chap. 5, pp. 330–332, 384, November. (General account of buffalo hunting in early days.)

OSBORN, HENRY FAIRFIELD. Seventeen skeletons of Moropus; probable habits of this animal. Proc. Nat. Acad. Sci., vol. 5, pp. 250–252, July. August 26, 1919.

OSBORN, HENRY FAIRFIELD. Palaeomastodon, the ancestor of the long-jawed mastodons only. Proc. Nat. Acad. Sci., vol. 5, pp. 265, 266. August 26, 1919.

OSBORN, HENRY FAIRFIELD. New titanotheres of the Huerfano. Bull. Amer. Mus. Nat. Hist., vol. 41, pp. 557–569, figs. 1–7. December 10, 1919. (One new genus and three new species.)

OSBORN, HENRY FAIRFIELD. Bibliography of Henry Fairfield Osborn for the years 1918, 1919. February, 1920. (Thirty titles.)

PERCIVAL, A. BLAYNEY. Concerning baboons. Journ. East. Africa and Uganda Nat. Hist. Soc., no. 14, p. 415, July, 1919. (A native child attacked by a baboon at Mount Kenia, British East Africa.)

POPE, SAXTON. Bear hunting with bows and arrows. California Fish and Game, vol. 5, no. 2, pp. 69, 70. April, 1919. (Account of killing of female black bear with arrows at Blocksburg, Humboldt County, California.)

POPE, SAXTON. After bear with bow and arrow. Forest and Stream, vol. 89, pp. 330, 331, 382. July, 1919. (Account of killing of female black bear in Humboldt County, California.)

RAMSTRÖM, M. Der Piltdown-Fund. Bull. Geol. Inst. Upsala, vol. 16, pp. 261–304, figs. 1–12. 1919. (Independently of Miller arrives at conclusion that the Piltdown jaw and teeth are those of a chimpanzee.)

REQUA, E. N. Sheep hunting in Mexico. Forest and Stream, vol. 89, pp. 204, 205, 252. May, 1919. (Account of a winter hunt southeast of Yuma, Arizona.)

REUTER, W. An account of a finback-whale (*Balaenoptera* spec.) which was washed ashore on the south coast of the Preanger Regencies in December, 1916. Treubia, vol. 1, pt. 3, pp. 101–138, pls. 1–20, text fig. 1. December, 1919. (Skeleton in Buitenzorg museum. Length 27.28 m., said to surpass that of any previously recorded specimen.

RICHMOND, CHARLES W. In Memoriam—Edgar Alexander Mearns, 1856–1916. Ann. Rep. Smithsonian Inst., 1917, pp. 649–662, plate 1. 1919. (Reprinted from the Auk, January, 1918.)

ROBINSON, H. C., AND C. BODEN KLOSS. On a collection of mammals from the Bencoolen and Palembang Residences, South West Sumatra. Journ. Fed. Malay States Mus., vol. 7, pt. 4, pp. 257–291, pl. 5, fig. 1. December, 1919. (35 forms enumerated, 2 new; *Tupaia minor humeralis* and *Rhinosciurus laticaudatus saturatus*.)

ROBINSON, H. C., AND C. BODEN KLOSS. On mammals, chiefly from the Ophir District, West Sumatra. Journ. Fed. Malay States Mus., vol. 7, pt. 4, pp. 299–323. December, 1919. (38 forms enumerated, one of which, *Mungos semitorquatus uniformis* is new.)

SAFFORD, W. E. Natural history of Paradise Key and the nearby Everglades of Florida. Ann. Rep. Smithsonian Inst., 1917, pp. 377–434; pls. 1–64; numerous figs. 1919. (Brief account of mammals, pp. 423–424.)

SCOTT, H. H., AND CLIVE E. LORD. Studies of Tasmanian Cetacea. Part III. *Tursiops tursio*, Southern Form. Roy. Soc. Tasmania: Pap. and Proc., 1919, pp. 96–109; 3 pls. November 24, 1919.

SHUFELDT, R. W. Four-footed foresters—the squirrels. Amer. Forestry, vol. 26, pp. 37–44, figs. 1–10. January, 1920. (A popular account of the American Sciuridæ.)

SHUFELDT, R. W. Complete list of my published writings, with brief biographical notes (second instalment). Medical Review of Reviews, vol. 26, pp. 70–75. February, 1920. (Covers the years 1889–1892; many of the 343 titles listed in these first instalments relate to mammals.)

SHUFELDT, R. W. The opossums. Amer. Forestry, vol. 26, pp. 96–101, 7 figs. February, 1920. (Popular account of American marsupials.)

SOUTHON, C. E. Some points of general interest on the subject of plague. Journ. East Africa and Uganda Nat. Hist. Soc., no. 14, pp. 361–381. July, 1919. (History, bacteriology, and preventive measures; of interest to all working on the extermination of the house rats.)

SOWERBY, ARTHUR DE CARLE. A new three-toed jerboa from China. Ann. and Mag. Nat. Hist., ser. 9, vol. 5, pp. 279–281. March, 1920. (Describes *Dipus halli* from Chih-feng, northeastern Chihli, China.)

STIGAND, C. H. The white rhino of the Lado. Forest and Stream, vol. 89, pp. 538, 539. October, 1919. (Account of habits and characteristics.)

STIGAND, C. H. The black rhino of the Lado. Forest and Stream, vol. 89, pp. 604, 605; 626, 627. November, 1919. (General account of habits and characteristics.)

STONER, DAYTON. An unsual example of incisor growth in the western fox squirrel. Iowa Acad. Science, vol. 25 (1918), pp. 105–106, pl. 1. (Owing to loss of tip of left lower incisor the unapposed left upper incisor grew unusually long, in an incomplete circle, covering the anterior opening of the infraorbital foramen.)

THOMAS, OLDFIELD. Two new species of *Sylvilagus* from Colombia. Ann. and Mag. Nat. Hist., ser. 9, vol. 5, pp. 31–33. January, 1920. (Describes *S. apollinaris* and *S. purgatus* from the Bogota region.)

THOMAS, OLDFIELD. A new shrew and two new foxes from Asia Minor and Palestine. Ann. and Mag. Nat. Hist., ser. 9, vol. 5, pp. 119–122. January, 1920. (Describes *Crocidura portali* from Ramleh, southeast of Jaffa; *Vulpes vulpes anatolica* from Smyrna; and *V. v. palæstina* from Ramleh.)

THOMAS, OLDFIELD. The generic positions of *"Mus" nigricauda*, Thos., and *woosnami*, Schwann. Ann. and Mag. Nat. Hist., ser. 9, vol. 5, pp. 140–142. January, 1920. (New genera: *Thallomys*, type *Mus nigricauda; Ochromys*, type *Mus woosnami;* both from Africa.)

THOMAS, OLDFIELD. A new *Taphozous* from the Sudan. Ann. and Mag. Nat. Hist., ser. 9, vol. 5, pp. 142–144. January, 1920. (Describes *Taphozous hamiltoni* from Mongalla.)

THOMAS, OLDFIELD. A new marmoset from the Peruvian Amazons. Ann. and Mag. Nat. Hist., ser. 9, vol. 5, p. 144. January, 1920. Describes *Leontocebus mounseyi* from Rio Pacaya, opposite Sapote, Lower Ucayali.)

THOMAS, OLDFIELD. Some note on *Babirussa*. Ann. and Mag. Nat. Hist., ser. 9, vol. 5, pp. 185–188. February, 1920. (Describes *Babirussa babyrussa frosti* from Tali Aboe Island, east of Celebes.)

THOMAS, OLDFIELD. A further collection of mammals from Jujuy. Ann. and Mag. Nat. Hist., ser. 9, vol. 5, pp. 188–196. February, 1920. (New genus: *Cynomops*, type *Molossus cerastes* Thomas; new subgenus: *Mallodelphys*, type *Didelphis langier* Desmarest; new species and subspecies: *Hesperomys musculinus cortensis* from Jujuy; *Ctenomys sylvanus utibilis* from Yuto, Rio San Francisco; *C. juris* from El Chaguarae; and *Marmosa budini* from Altura de Yuto.)

THOMAS, OLDFIELD. Two new Asiatic bats of the genera *Tadarida* and *Dyacopterus*. Ann. and Mag. Nat. Hist., ser. 9, vol. 5, pp. 283–285. March, 1920. (Describes *Tadarida latouchei* from northeastern Chihli, China; and *Dyacopterus brooksi* from Sumatra.)

THOMAS, OLDFIELD. Four new squirrels of the genus *Tamiops*. Ann. and Mag. Nat. Hist., ser. 9, vol. 5, pp. 304–308. March, 1920. (Describes *T. clarkei*, *T. maritimus forresti*, and *T. inconstans* from Yunnan; and *T. lylei* from Siam.)

THOMPSON, CYRUS. A Wyoming sheep hunt. Forest and Stream, vol. 89, pp. 420, 439, 440. August, 1919. (Account of killing of mountain sheep in Wind River Mountains, Wyoming.)

VAN SOMEREN, V. G. L. Ant-bear or aard vark. Journ. East Africa and Uganda Nat. Hist. Soc., no. 14, p. 421. July, 1919. (Recent unusual abundance in British East Africa.)

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CORRESPONDENCE

FOOD STORED BY THE BEAN MOUSE

To the Editor of the Journal of Mammalogy:

I read with great interest the article by Mr. Vernon Bailey in the February issue of the Journal on the Identity of the Bean Mouse. In regard to a statement in the third paragraph of that article perhaps it would be well to make here a slight correction. It was stated that "They are large, fleshy beans produced on underground shoots of a trifoliate bean vine, *Falcata comosa*."

Now as a matter of fact the large beans are not produced on underground shoots. They are produced underground on the extremities of branches which are above ground, running along the surface of the ground. These lower branches of the bean plant start out from the base of the main stem of the plant and run along the surface, making a perfect network of branches lying upon the surface of the ground under the overgrowth of the leafy branches of the plant which climb upon bushes and other vegetation. If the upper, leafy part of one of these bean plants be carefully cut away without disturbing the lower, basal branches they will appear like a lacy network of white threads upon the surface of the ground.

Falcata grows in dense masses of vines over other vegetation in some places, using such vegetation to climb up into the air and light. It has two kinds of branches, the upper, climbing branches, and the basal, prostrate branches which creep along the ground in the shade of the upper growth. These two kinds of branches on the same plant produce two kinds of flowers, from which result two forms of fruits. The upper, leafy branches bear petaliferous, insect-attracting flowers, from which result small brown bean pods from one-fourth inch to one-half inch in length. Within these pods are produced 3, 4, or 5 small mottled beans of $\frac{3}{16}$ to $\frac{5}{16}$ inch in length.

The basal branches, in conformity with their position prostrate on the surface of the ground in the shade of the upper growth are leafless and colorless. Also in conformity with their position away from possible insect visitors their flowers are not petaliferous, but cleistogamous. This self-pollinated flower produces a pod which at once pushes itself into the soft leafmold and loose soil and there develops its single large bean. This ground bean is about the size of the common lima bean, but not so flat. It is of uneven form but thicker, while not so long as the lima bean.

The fruits of both upper and basal branches are equally useful to the species for reproduction, the one being supplementary to the other, and a sort of precautionary provision in case of failure of production of either the one or the other from exigencies of weather or other conditions. Furthermore, it is a curious thing that if the fruits of the basal branches are unable to cover themselves in the soil they will develop in all manner like the fruits of the upper branches, growing small and hard and covered with a thick pod instead of the thin membranaceous covering which develops when it succeeds in burying itself in the soil. Likewise if the basal branches are exposed to the light they do not differ from the upper branches in color.

Melvin R. Gilmore.

Bismarck, North Dakota,
March 9, 1920.

A PLEA FOR MORE CONCISE TECHNICAL PAPERS

To the Editor of the Journal:

Now that so many excellent suggestions and criticisms anent the standardizing of observations, using common sense in regard to vernacular names, and kindred topics, are appearing in the Journal, the time seems propitious for calling attention to another matter, and that is the lack of system often to be noted in technical work.

For a long time, when one had occasion to name a new form, brevity seemed to be the height of style, and the rule was for an original description to consist of about a dozen lines. Little more than the designation of a type was attempted, with the result that if one wished to learn the ways in which the new form differed from its close relatives, he was obliged to work this out for himself—if he had the material to do so. Almost anything is better than such fragmentary information. Now, however, the pendulum of style seems to be swinging to the other extreme, and one frequently encounters comparatively unimportant facts and theories of a systematic nature that are clothed with a wealth of detail worthy of more important subjects. Studies that are of a more pretentious character are often buried beneath a perfect avalanche of detail and ultra-scientific language that confuses even the experienced systematist. Why is this necessary? Is it a subconscious effort on the part of the author to impress the reader with his scientific weight? Any zoologist can awe the layman with nomenclatural camouflage, but the more advanced student is impressed only by the annoyance of having to wade through page after page of minutiæ while searching for something of real use to him. Perhaps this is only a manifestation of one's enthusiasm and a tendency to be carried away by one's subject, but the fact remains that continual watchfulness and care are necessary in order properly to correlate the unimportant with the important matters, and not overemphasize the former. If due attention is given to such points, not only will the systematic work of others be facilitated, but much of the derision which the general public aims at the strictly scientific worker, because of his excited strivings over, and voluminous publications on, what may well be expressed by the word "piffle," will be annulled.

A. Brazier Howell.

EDITORIAL COMMENT

A Northern California Section of the American Society of Mammalogists was formed at Berkeley, California, on the evening of February 5, 1920. Mr. Tracy I. Storer informs us that the meeting, which was held at the California Museum of Vertebrate Zoology, was attended by the following: A. K. Fisher, J. Grinnell, A. B. Howell, W. C. Jacobsen, I. M. Johnston, J. E. Law, L. Little, D. D. McLean, J. Mailliard, C. R. Russell, T. I. Storer, H. S. Swarth, and H. G. White. Officers elected for the ensuing year are as follows: President, Joseph Dixon; Vice-President, Joseph Mailliard; Secretary, Tracy I. Storer. Until further notice the Section will meet on the first Thursday of every month at the Museum of Vertebrate Zoology, University of California. Mr. Storer extends an invitation to all members of the Society who may be visiting California to "drop in" at any of the meetings and will be glad if such members can present papers before the section.

Dr. Walter P. Taylor tells us of the organization at Seattle, Washington, on January 7, 1920, of the Pacific Northwest Bird and Mammal Club, with officers as follows: President, Prof. F. S. Hall, University of Washington; Vice-President, J. Hooper Bowles, Tacoma; Secretary and Treasurer, Stanton Warburton, Jr., University of Washington. Thirteen persons were present at the organization meeting and letters were received from others who wished to become charter members. The State Museum at the University of Washington is the official home of the club and the field of operations includes northern Oregon, Washington, British Columbia, and Alaska.

The actual date of publication of the February number of the Journal of Mammalogy was March 2, 1920. The schedule for printing the Journal has now been advanced, so that the date of issue for each number should come early in the regular month of publication, and chances for serious delay will be reduced to a minimum.

It is only natural that many of the members of the Society or readers of the Journal should be more interested in North American mammals than in those of any other country; and it is doubtless true that a large proportion of our pages should at present be devoted to papers on Nearctic forms. It comes as something of a surprise however that members should seriously consider and actually advocate limiting the Journal very largely if not altogether to accounts of our native species. It is highly proper that certain individuals or institutions should specialize on the fauna of a definite region, on a limited part of such fauna, or, if they w sh, on a single family or genus. But for one who does specialize in any of these ways, no matter how intensive his studies, a general knowledge of the group at large would seem to be imperative. A zoologist may confine his real labors, his published results, to a single group or a limited locality but unless his interest and study extend to related forms and regions his work can not be of the highest order. A real interest in the study of mammalogy carries with it an intense desire for information beyond the limits of a county, state, or continent. What of the exact relationships with Old World or Neotropical forms? How about

the extinct species of the same or related groups? How do specialists in other countries, or workers in other fields, handle such and such questions? These are all matters having a vital interest in the work of any specialist, and, if they are ignored, only inferior work can result. It is hard to imagine a student especially interested in any group of mammals or in the fauna of any given region who does not keenly desire to learn all he can of the related forms of the world, living or extinct, or of the technique of other workers who are dealing with them. Such a student is handicapped beyond measure.

The future of the fur-bearing animals looks dark indeed. Virtual extinction of many species is imminent unless prompt and effective means for their protection are devised and enforced. The tremendous popularity of furs of all kinds, the greatly increased number of persons who can or do afford expensive clothing of this kind, and the consequent price on the head of every living fur-bearer, threaten speedily to wipe certain mammals from the face of the earth. It is absolutely certain that many species can withstand the present yearly toll only a short while longer. With raw skunk skins selling in New York City during February up to $12.50 each wholesale, what chance has the animal for existence as a wild creature?

The offerings at the New York raw fur sale in February included over 1,121,000 domestic skins, and a very great many more from foreign countries. Among those listed were 27,000 red fox, 175,000 opossum, 73,000 raccoon, 32,000 wolf (probably including coyote), 239,000 skunk, 4350 badger, 6200 gray fox, 41,500 mink, 7700 marten, 58,000 civet cat, 68,000 ermine, and 9800 wild cat and lynx. The foreign items included, for example, 234,000 Australian opossum, 325,000 squirrel, and 23,500 kangaroo and wallaby skins. This is only one sale in one city, but newspaper reports state that the receipts totaled $10,600,000.

The fur-bearing animals are a mighty asset to the country, but unless they are carefully guarded by wise legislation and a favorable public sentiment we will soon be without them. It is doubtful if the "fur farms" can furnish enough skins to keep the particular species raised on them in fashionable demand. The main supply must come from wild-killed animals, and few species can long stand the present killing. Those familiar with conditions in the field know only too well that the time of practical extinction for several valuable species is dangerously near at hand. Vernon Bailey, chief field naturalist of the Biological Survey, once estimated that every living badger on a western ranch was worth $100 to the land-owner as a destroyer of noxious rodents, and the economic value of the skunk and others of the smaller carnivores is well known. But here are the skins of 4350 of these one-hundred-dollar badgers offered in one sale of raw furs, together with the skins of 239,000 grubworm destroying skunks, which will be manufactured into articles to be used a comparatively short time and discarded. It is a question if many of the mammals suffering this depletion from the demands of fashion are not of more permanent value to the country in other ways, and their certain extermination a serious national loss. —N. H.